Supporting Information

Photocatalytic Reductive Fluoroalkylation of Nitrones

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Content

General Methods: All reactions were performed under an argon atmosphere. Column chromatography was carried out employing silica gel (230-400 mesh). Precoated silica gel plates F-254 were used for thin-layer analytical chromatography visualizing with UV and/or acidic aq. KMnO4 solution. High resolution mass spectra (HRMS) were measured using electrospray ionization (ESI) and time-of-flight (TOF) mass analyzer. The measurements were done in a positive ion mode (interface capillary voltage –4500 V) or in a negative ion mode (3200 V); mass range from m/z 50 to m/z 3000. For irradiation, a strip of light emitting diodes (2835-120LED 1M-Blue, 12V) was used.

Reagents. The following starting compounds were prepared according to literature procedures: *N*-(benzylidene)methylamine *N*-oxide (**1a**),[1] *N*-(benzylidene)benzylamine *N*-oxide,[2] 3,4-dihydroisoquinoline *N*-oxide,[2] *N*-(benzylidene)-*tert*-butylamine *N*-oxide,[2] *N*-(2-methylpropylidene)benzylamine *N*-oxide,[3] *N*-(2-pyridylene)methylamine *N*-oxide,[4] *N*-methyl-(2,2-dimethylpropylidene)-amine *N*-oxide,[5] *N*-[4-(methoxycarbonyl)benzylidene]methanamine *N*-oxide,[6] *N*-(3-phenylpropylidene)methanamine *N*-oxide,[7] *N*-(4-methoxybenzylidene)methanamine *N*-oxide,[8] *N*-(4-cyanobenzylidene)methanamine *N*-oxide,[9] *N*-(2-hydroxybenzylidene)methanamine *N*-oxide,[10] (2,2-difluoro-2-iodoethyl)benzene (**2a**),[11] for trifluoromethyl and pentafluoroethyl iodides, solutions in DMSO were used.[12]

Fluoroalkylation of nitrones 1. Synthesis of compounds 3a-z,π,σ and 6a-h (General Procedure). Photocatalyst $Ir(ppy)_2(dtbbpy)PF_6$ (2.3 mg, 0.0025 mmol), nitrone **1** (0.50 mmol), and ascorbic acid (132 mg, 0.75 mmol) were placed in a tube containing a stirring bar. The tube was evacuated and filled with argon. DMSO (1 mL) was added followed by amine [for **3a**,**π** NEt_3, 76 mg, 0.75 mmol; for **3b-z,σ**, 2,4,6-collidine, 91 mg, 0.75 mmol; for **6a-h**, morpholine, 109 mg, 1.25 mmol) and fluoralkyl iodide (for **3a-p,r,s,z,π,σ, 6a-d,f-h**, 0.75 mmol; for **3q,t-y, 6e**, 0.50 mmol). The reaction vessel was irradiated by a strip of blue LEDs with water cooling to maintain reaction temperature around 23–25 °C for 2 hours. For the work-up, the mixture was treated with water (10 mL) and extracted with EtOAc (3×4 mL). The combined organic phases were dried with Na_2SO_4 and concentrated under vacuum, and the residue was purified by column chromatography.

Trifluoromethylation of nitrone 1a (representative example on 1 mmol scale). Photocatalyst $Ir(ppy)_2(dtbbpy)PF_6$ (4.6 mg, 0.005 mmol), nitrone **1a** (135 mg, 1.0 mmol), and ascorbic acid (264 mg, 1.5 mmol) were placed in a tube containing a stirring bar. The tube was evacuated and filled with argon. DMSO (2 mL) was added followed by 2,4,6-collidine (182 mg, 1.5 mmol) and a solution of CF_3I (528 mg of 56% solution in DMSO, 1.5 mmol). The reaction vessel was irradiated by a strip of blue LEDs with water cooling to maintain reaction temperature around 23–25 °C for 2 hours. For the work-up, the mixture was treated with water (10 mL) and extracted with EtOAc (3×4 mL). The combined organic phases were dried with Na_2SO_4 and concentrated under vacuum, and the residue was purified by column chromatography eluting with hexanes/EtOAc, 5/1, affording 154 mg (75% yield) of compound **3b**.

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[5] Aurich, H. G.; Franzke, M.; Kesselheim, H. P.; Rohr, M. *Tetrahedron* **1992**, *48*, 669–682.
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[10] Chen, S.; Zhao, K.; Chen, G. *J. Chem.* **2015**, *2015*, 1–6.
[11] Levin, V. V.; Zemtsov, A. A.; Struchkova, M. I.; Dilman, A. D. *Org. Lett.* **2013**, *15*, 917–919.
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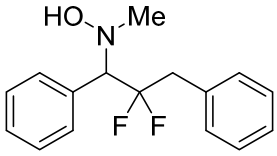
***N*-(2,2-Difluoro-1,3-diphenylpropyl)-*N*-methylhydroxylamine (3a).**



Yield 120 mg (86%). Colorless crystals. Mp 138-140 °C. Chromatography: hexanes/EtOAc, 4/1. R_f 0.24 (hexanes/EtOAc, 4/1).

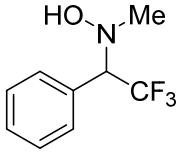
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.46–7.23 (m, 10H), 5.23 (s, 1H), 3.80 (t, *J* = 13.6 Hz, 1H), 3.38 (td, *J* = 17.2, 14.6 Hz, 1H), 3.20 (td, *J* = 17.2, 14.6 Hz, 1H), 2.56 (s, 3H).

^{13}C NMR (75 MHz, DMSO-d_6) δ: 133.8 (d, *J* = 4.0 Hz), 133.3, 131.5, 130.9, 128.3, 128.1, 127.9, 127.1, 123.6 (dd, *J* = 241.8, 250.2 Hz), 73.8 (dd, *J* = 22.1, 28.2 Hz), 46.5, 40.5 (t, *J* = 24.0 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ: -100.9 (m).

HRMS (ESI): calcd for $C_{16}H_{18}F_2NO$ (M+H) 278.1351; found 278.1352.

***N*-Methyl-*N*-(2,2,2-trifluoro-1-phenylethyl)hydroxylamine (3b).**



According to General Procedure, yield 84 mg (82%). Colorless crystals. Mp 112–113 °C. Chromatography: hexanes/EtOAc, 5/1. R_f 0.27 (hexanes/EtOAc, 5/1).

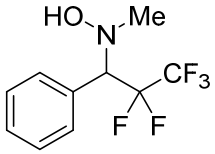
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.47–7.39 (m, 5H), 4.10 (q, *J* = 7.6 Hz, 1H), 2.57 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 131.2, 130.3, 129.5, 128.7, 124.9 (q, *J* = 281.8 Hz), 74.2 (q, *J* = 27.5 Hz), 46.4.

^{19}F NMR (282 MHz, $CDCl_3$) δ: -68.9 (d, *J* = 7.6 Hz).

HRMS (ESI): calcd for $C_9H_{11}F_3NO$ (M+H) 206.0787; found 206.0793.

***N*-Methyl-*N*-(2,2,3,3,3-pentafluoro-1-phenylpropyl)hydroxylamine (3c)**



Yield 117 mg (92%). Colorless crystals. Mp 71–73 °C. Chromatography: hexanes/EtOAc, 7/1. R_f 0.38 (hexanes/EtOAc, 5/1).

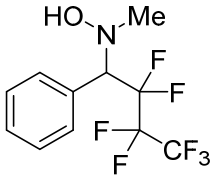
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.54–7.39 (m, 5H), 5.44 (s, 1H), 4.16 (d, *J* = 17.5, 12.1 Hz, 1H), 2.54 (s, 3H).

^{13}C NMR (75.5 MHz, CDCl3) δ: 131.7, 129.5, 129.0, 128.5, 119.3 (qt, *J* = 286.9, 35.8 Hz), 114.7 (ddq, *J* = 262.9, 255.7, 35.3 Hz), 71.2 (dd, *J* = 24.7, 18.4 Hz), 46.1.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –82.7 (s, 3F), –116.2 (dd, *J* = 275.8, 11.7 Hz, 1F), –121.3 (dd, *J* = 275.8, 17.1 Hz, 1F).

HRMS (ESI): calcd for $C_{10}H_{11}F_5NO$ (M+H) 256.0755; found 256.0757.

***N*-(2,2,3,3,4,4,4-Heptafluoro-1-phenylbutyl)-*N*-methylhydroxylamine (3d).**



Yield 145 mg (94%). Colorless crystals. Mp 52–54 °C. Chromatography: hexanes/EtOAc, 1/5. R_f 0.30 (hexanes/EtOAc, 1/5).

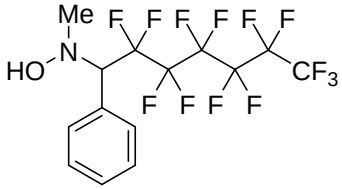
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.57–7.40 (m, 5H), 5.77 (s, 1H), 4.28 (dd, *J* = 17.4, 12.2 Hz, 1H), 2.56 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 131.8, 129.5, 128.9, 128.4, 71.1 (dd, *J* = 24.8, 18.3 Hz), 45.9.

^{19}F NMR (282 MHz, $CDCl_3$) δ: -81.6 (t, *J* = 10.8 Hz, 3F), -113.8 (dm, *J* = 283.5 Hz, 1F), -118.2 (dm, *J* = 283.5 Hz, 1F), -126.1 (t, *J* = -5.9 Hz, 2F).

HRMS (ESI): calcd for $C_{11}H_{11}F_7NO$ (M+H) 306.0723; found 306.0728.

***N*-Methyl-*N*-(2,2,3,3,4,4,5,5,6,6,7,7,7-tridecafluoro-1-phenylheptyl)hydroxylamine (3e).**



Yield 225 mg (99%). Colorless crystals. Mp 46–49 °C. Chromatography: hexanes/EtOAc, 10/1. R_f 0.30 (hexanes/EtOAc, 10/1).

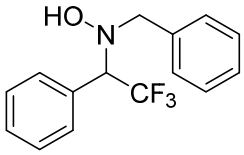
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.87–7.45 (m, 5H), 5.83 (br s, 1H), 4.35 (dd, *J* = 17.4, 12.2 Hz, 1H), 2.61 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 131.9, 129.5, 129.0, 128.4, 71.4 (dd, *J* = 25.2, 18.4 Hz), 46.0.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –81.9 (t, *J* = 9.8 Hz, 3F), –112.9 (dm, *J* = 284.2 Hz, 1F), –117.6 (dm, *J* = 284.2 Hz, 1F), –121.9 (m, 2F), –122.8 (m, 2F), –123.7) (m, 2F), –127.2 (m, 2F).

HRMS (ESI): calcd for $C_{14}H_{11}F_{13}NO$ (M+H) 456.0628; found 456.0628.

***N*-Benzyl-*N*-(2,2,2-trifluoro-1-phenylethyl)hydroxylamine (3f).**



Yield 127 mg (91%). Colorless crystals. Mp 83–84 °C. Chromatography: hexanes/EtOAc 5/1. R_f 0.36 (hexanes/EtOAc, 5/1).

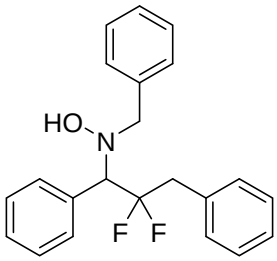
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.60–7.32 (m, 10H), 5.27 (s, 1H), 4.32 (q, *J* = 7.8 Hz, 1H), 3.90 (d, *J* = 13.2 Hz, 1H), 3.69 (d, *J* = 13.2 Hz, 1H)

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 136.9, 131.0, 130.6, 129.4, 129.4, 128.7, 128.6, 127.8, 125.1 (q, *J* = 281 Hz), 71.4 (q, *J* = 28.0 Hz), 61.7.

^{19}F NMR (282 MHz, $CDCl_3$) δ: -68.9 Hz (d, *J* = 7.8 Hz).

HRMS (ESI): calcd for $C_{15}H_{15}F_3NO$ (M+H) 282.1100; found 282.1102.

***N*-Benzyl-*N*-(2,2-difluoro-1,3-diphenylpropyl)hydroxylamine (3g).**



Yield 140 mg (79%). Colorless oil. Chromatography: hexanes/EtOAc, 6/1. R_f 0.38 (hexanes/EtOAc, 5/1).

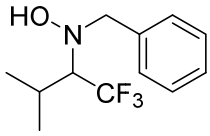
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.66–7.33 (m, 15H), 5.13 (s, 1H), 4.08 (dd, *J* = 17.3, 10.4 Hz, 1H), 3.89 (d, *J* = 13.2 Hz, 1H), 3.68 (d, *J* = 13.2 Hz, 1H), 3.59-3.30 (m, 2H).

^{13}C NMR (50 MHz, $CDCl_3$) δ: 137.5, 133.2 (dd, *J* = 5.1, 3.0 Hz), 132.2, 131.6, 130.8, 129.5, 128.6, 128.4, 128.3, 128.2, 127.5, 127.3, 123.4 (dd, *J* = 250.7, 246.5 Hz), 71.9 (dd, *J* = 26.3, 22.9 Hz), 61.9, 41.9 (t, *J* = 24.9 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ: -98.7 (dm, *J* = 252.2 Hz, 1F), -101.0 (dm, *J* = 252.2 Hz, 1F).

HRMS (ESI): calcd for $C_{22}H_{22}F_2NO$ (M+H) 354.1664; found 354.1668.

***N*-Benzyl-*N*-(1,1,1-trifluoro-3-methylbutan-2-yl)hydroxylamine (3h).**



Yield 114 mg (92%). Colorless crystals. Mp 50–52 °C. Chromatography: hexanes/EtOAc, 5/1. R_f 0.30 (hexanes/EtOAc, 5/1).

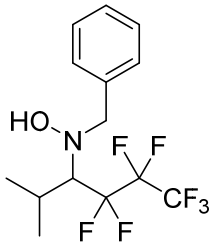
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.41–7.32 (m, 5H), 4.89 (s, 1H), 4.23 (d, *J* = 13.4, 1H), 4.05 (d, *J* = 13.4, 1H), 3.06 (qd, *J* = 8.5, 6.9 Hz, 1H), 2.25 (octet, *J* = 6.9 Hz, 1H), 1.19 (d, *J* = 6.9 Hz, 3H), 1.15 (dd, *J* = 6.9, 1.4 Hz, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 138.0, 129.3, 128.6, 127.7, 126.7 (q, *J* = 289.6 Hz), 71.5 (q, *J* = 23.7 Hz), 61.8 (q, *J* = 1.6 Hz), 27.2 (q, *J* = 1.1 Hz), 21.3, 20.1 (q, *J* = 2.0 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ: -64.3 (d, *J* = 8.5 Hz)

HRMS (ESI): calcd for $C_{12}H_{17}F_3NO$ (M+H) 248.1257; found 248.1255.

***N*-Benzyl-*N*-(4,4,5,5,6,6,6-heptafluoro-2-methylhexan-3-yl)hydroxylamine (3i).**



Yield 131 mg (75%). Colorless oil. Chromatography: hexanes/EtOAc, 8/1. R_f 0.50 (hexanes/EtOAc, 5/1).

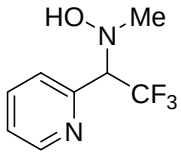
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.38–7.29 (m, 5H), 4.64 (s, 1H), 4.20 (d, *J* = 13.2 Hz, 1H), 3.97 (d, *J* = 13.2 Hz, 1H), 3.37 (dm, *J* = 23.9 Hz, 1H), 2.61 (dtd, *J* = 13.9, 7.0, 3.4 Hz), 1.29 (dt, *J* = 6.9, 1.9 Hz, 3H), 1.26 (dd, *J* = 7.2, 1.1 Hz, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 137.6, 129.3, 128.6, 127.8, -118.8 (dddd, *J* = 293.7, 258.2, 30.7, 25.9 Hz) , -118.4 (qt, *J* = 288.2, 34.7 Hz), -109.8 (ddq, *J* = 268.4, 264.6, 37.0 Hz), 68.5 (dd, *J* = 24.9, 18.6 Hz), 62.7 (t, *J* = 2.1 Hz), 26.5, 22.9 (d, *J* = 3.3 Hz), 20.8 (t, *J* = 30.1 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ: –81.3 (dd, *J* = 13.7, 8.6 Hz, 3F), –112.1 (dm, *J* = 287.4 Hz, 1F), –119.2 (dm, *J* = 287.4, 8.1 Hz, 1F), –123.9 (ddd, *J* = 286.9, 13.7, 8.0 Hz, 1F), –127.6 (dd, *J* = 286.8, 15.1 Hz, 1F).

HRMS (ESI): calcd for $C_{14}H_{17}F_7NO$ (M+H) 348.1193; found 348.1186.

_N_-Methyl-_N_-(2,2,2-trifluoro-1-(pyridin-2-yl)ethyl)hydroxylamine (3j).



Yield 79 mg (77%). Colorless crystals. Mp 77–79 °C. Chromatography: hexanes/EtOAc, 1/1. R_f 0.30 (hexanes/EtOAc, 1/1).

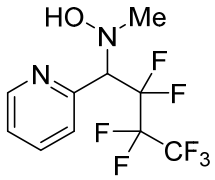
^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.59 (d, *J* = 4.1 Hz, 1H), 7.79–7.71 (m, 2H), 7.60 (d, *J* = 7.7 Hz, 1H), 7.33 (t, *J* = 5.8 Hz, 1H), 4.44 (q, *J* = 7.7 Hz, 1H), 2.66 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 152.0, 149.0, 137.0, 125.2, 124.6 (q, *J* = 282.1), 124.1, 73.9 (q, J = 27.6 Hz), 46.5.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –69.2 (d, *J* = 7.7 Hz).

HRMS (ESI): calcd for $C_8H_{10}F_3N_2O$ (M+H) 207.0740; found 207.0733.

_N_-(2,2,3,3,4,4,4-heptafluoro-1-(pyridin-2-yl)butyl)-_N_-methylhydroxylamine (3k)



Yield 110 mg (72%). Colorless crystals. Mp 80–82 °C. Chromatography: hexanes/EtOAc, 2/1. R_f 0.32 (hexanes/EtOAc, 2/1).

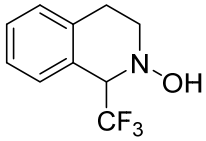
^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.59 (ddd, *J* = 4.9, 1.6, 0.9 Hz, 1H), 7.77–7.70 (m, 2H), 7.55 (s, 1H), 7.33 (ddd, *J* = 7.4, 4.9, 2.4 Hz, 1H), 4.58 (dd, *J* = 19.5, 10.3 Hz, 1H), 2.61 (s, 3H).

^{19}F NMR (282 MHz, $CDCl_3$) δ: –81.6 (dd, *J* = 12.4, 9.0 Hz, 3F), –112.8 (d, sept, *J* = 284.9, 11.9 Hz, 1F), –119.4 (dm, *J* = 284.9, 1F), –125.5 (ddd, *J* = 290.0, 12.1, 6.6 Hz, 1F), –127.4 (dd, J = 290.0, 12.6 Hz, 1F).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 150.9, 148.7, 136.7, 126.8, 124.2, 71.0 (dd, *J* = 25.6, 18.1 Hz), 46.3.

HRMS (ESI): calcd for $C_{10}H_{10}F_7N_2O$ (M+H) 307.0676; found 307.0666.

1-(Trifluoromethyl)-3,4-dihydroisoquinolin-2(1*H*)-ol (3l).



Yield 89 mg (82%). Colorless oil. Chromatography: hexanes/EtOAc, 5/1. R_f 0.28 (hexanes/EtOAc, 5/1).

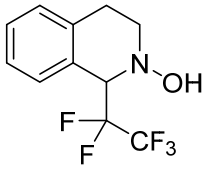
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.42–7.22 (m, 5H), 4.77 (q, *J* = 7.7, 1H), 3.56 (dt, *J* = 11.3, 5.2 Hz, 1H), 3.27 (ddd, *J* = 11.3, 8.2, 4.7 Hz, 1H), 3.06–2.93 (m, 2H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 136.0, 128.8, 128.6, 128.4, 127.3, 126.6, 125.3 (q, *J* = 280.0 Hz), 68.6 (q, *J* = 27.0 Hz), 52.4, 26.4.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –72.5 (d, *J* = 7.7 Hz).

HRMS (ESI): calcd for $C_{10}H_{11}F_3NO$ (M+H) 218.0787; found 218.0795.

1-(Perfluoroethyl)-3,4-dihydroisoquinolin-2(1H)-ol (3m).



Yield 111 mg (83%). Colorless crystals. Mp 47–50 °C. Chromatography: hexanes/EtOAc, 5/1. R_f 0.38 (hexanes/EtOAc, 5/1).

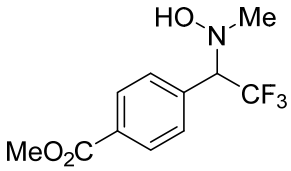
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.39–7.22 (m, 4H), 5.99 (br. s, 1H), 4.81 (dd, *J* = 20.7, 8.4 Hz, 1H), 3.51-3.41 (m, 1H), 3.35–3.26 (m, 1H), 3.09 (ddd, *J* = 16.4, 8.2, 4.8 Hz, 1H), 2.82 (dt, *J* = 16.4, 5.4 Hz, 1H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 136.4, 129.4 (d, *J* = 4.9 Hz), 128.7, 128.5, 126.5, 126.3, 119.5 (qdd, *J* = 287.2, 36.9, 35.4 Hz), 114.1 (ddq, *J* = 260.2, 254.9, 35.3 Hz), 67.1 (t, *J* = 22.9 Hz), 51.2 (d, *J* = 2.5 Hz), 24.5.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –81.4 (s, 3F), –112.8 (dd, *J* = 278.8, 8.7, 2.9 Hz, 1F), –122.2 (dd, J = 278.8, 20.9 Hz, 1F).

HRMS (ESI): calcd for $C_{11}H_{11}F_5NO$ (M+H) 268.0755; found 268.0742.

Methyl 4-{2,2,2-trifluoro-1-[hydroxy(methyl)amino]ethyl}benzoate (3n).



Yield 100 mg (76%). Colorless crystals. Mp 95–96 °C. Chromatography: hexanes/EtOAc, 3/1. R_f 0.24 (hexanes/EtOAc, 3/1).

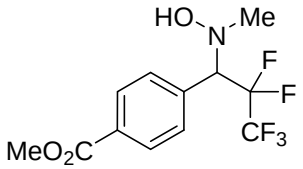
^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.05 (d, *J* = 8.2 Hz, 2H), 7.52 (d, *J* = 8.2 Hz, 2H), 6.45 (s, 1H), 4.15 (q, *J* = 7.5 Hz, 1H), 3.91 (s, 3H), 2.55 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 166.8, 135.9, 131.1, 130.4, 129.8, 124.5 (q, *J* = 281.7 Hz), 73.6 (q, *J* = 27.8 Hz), 52.4, 46.4.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –68.9 (d, *J* = 7.1 Hz).

HRMS (ESI): calcd for $C_{11}H_{13}F_3NO_3$ (M+H) 264.0842; found 264.0838.

Methyl 4-{2,2,3,3,3-pentafluoro-1-[hydroxy(methyl)amino]propyl}benzoate (3o).



Yield 146 mg (93%). Colorless crystals. Mp 129–130 °C. Chromatography: hexanes/EtOAc, 4/1. R_f 0.22 (hexanes/EtOAc, 5/1).

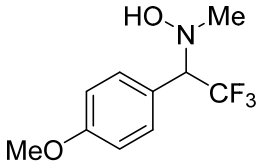
^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.06 (d, *J* = 8.3 Hz, 2H), 7.59 (d, *J* = 8.3 Hz, 2H), 5.84 (s, 1H), 4.20 (dd, *J* = 17.8, 11.7 Hz, 1H), 3.91 (s, 3H), 2.51 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 166.9, 134.0, 131.8, 131.2, 129.5, 121.1 (qt, *J* = 287.0, 35.6 Hz), 114.4 (ddq, *J* = 263.7, 255.3, 35.6 Hz), 70.7 (dd, *J* = 25.2, 18.5 Hz), 52.4, 46.1.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –82.8 (s, 3F), –115.9 (dd, *J* = 276.8, 11.3 Hz, 1F), –121.7 (dd, *J* = 276.8, 17.4 Hz, 1F)

HRMS (ESI): calcd for $C_{12}H_{13}F_5NO_3$ (M+H) 314.0810; found 314.0809.

Methyl 4-(2,2,3,3,3-pentafluoro-1-(hydroxy(methyl)amino)propyl)benzoate (3p).



Yield 80 mg (68%). Colorless crystals. Mp 119–120 °C. Chromatography: hexanes/EtOAc, 3/1. R_f 0.28 (hexanes/EtOAc, 3/1).

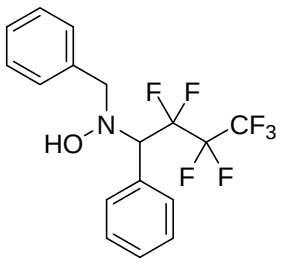
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.36 (d, *J* = 8.7 Hz, 2H), 6.92 (d, *J* = 8.7 Hz, 2H), 6.26 (s, 1H), 4.04 (q, *J* = 7.7 Hz, 1H), 3.82 (s, 3H), 2.55 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 160.4, 131.5, 125.0 (q, *J* = 281.6 Hz), 123.1, 114.1, 73.4 (q, *J* = 27.6 Hz), 55.4, 46.3.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –69.3 (d, *J* = 7.7 Hz).

HRMS (ESI): calcd for $C_{10}H_{13}F_3NO_2$ (M+H) 236.0893; found 236.0894.

***N*-Benzyl-*N*-(2,2,3,3,4,4,4-heptafluoro-1-phenylbutyl)hydroxylamine (3q).**



Yield 131 mg (69%). Colorless oil. Chromatography: hexanes/EtOAc, 10/1. R_f 0.50 (hexanes/EtOAc, 5/1).

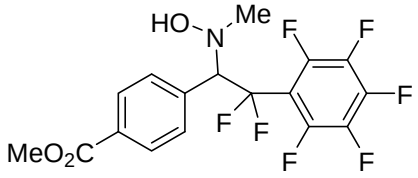
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.70–7.35 (m, 10H), 5.03 (s, 1H), 4.48 (dd, *J* = 21.3, 8.9 Hz, 1H), 3.90 (d, *J* = 13.1 Hz, 1H), 3.76 (d, *J* = 13.1 Hz, 1H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 136.7, 132.1, 129.5, 129.4, 129.1, 128.6, 128.4, 127.9, 68.8 (dd, *J* = 27.2, 18.5 Hz), 62.0.

^{19}F NMR (282 MHz, $CDCl_3$) δ: -81.6 (dd, *J* = 13.0, 9.0 Hz, 3F), -111.5 (dm, *J* = 285.4, 1F), -119.0 (dm, *J* = 285.4,), -125.3 (ddd, *J* = 290.0, 13.4, 7.8 Hz, 1F), -127.4 (dd, *J* = 290.0, 14.8 Hz, 1F)

HRMS (ESI): calcd for $C_{17}H_{15}F_7NO$ (M+H) 382.1036; found 382.1036.

Methyl 4-(2,2-difluoro-1-(hydroxy(methyl)amino)-2-(perfluorophenyl)ethyl)benzoate (3r)



Yield 169 mg (82%). Colorless crystals. Mp 114–117 °C. Chromatography: hexanes/EtOAc, 4/1. R_f 0.22 (hexanes/EtOAc, 5/1).

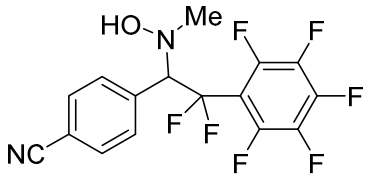
^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.03 (d, *J* = 8.0 Hz, 2H), 7.57 (d, *J* = 8.0 Hz, 2H), 5.76 (s, 1H), 4.26 (dd, *J* = 19.5, 7.8 Hz, 1H), 3.92 (s, 3H), 2.51 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 166.9, 144.7 (d, *J* = 256.1 Hz), 142.2 (d, *J* = 258.1 Hz), 137.8 (d, J = 249.2 Hz), 136.5, 131.2, 130.9, 129.6, 119.8 (dd, *J* = 258.2, 250.5 Hz), 111.9 (m), 76.3 (dd, *J* = 27.6, 22.4 Hz), 52.3, 46.8.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –91.8 (dt, *J* = 272.1, 23.9 Hz, 1F), –101.2 (ddd, *J* = 272.1, 51.7, 30.7 Hz, 1F), –140.9-(-141.2) (m, 2F), –151.4 (t, *J* = 21.2 Hz, 1F), –161.5-(–161.7) (m, 2F).

HRMS (ESI): calcd for $C_{17}H_{13}F_7NO_3$ (M+H) 412.0778; found 412.0764.

4-(2,2-Difluoro-1-(hydroxy(methyl)amino)-2-(perfluorophenyl)ethyl)benzonitrile (3s).



Yield 170 mg (90%). Colorless crystals. Mp 109–112 °C. Chromatography: hexanes/EtOAc, 3/1. R_f 0.36 (hexanes/EtOAc, 3/1).

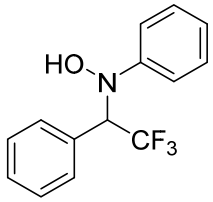
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.66 (s, 4H), 5.48 (br s, 1H), 4.21 (dd, *J* = 21.1, 6.1 Hz), 2.48 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 144.7 (d, *J* = 254.9 Hz), 142.3 (d, *J* = 258.3 Hz), 138.2 (d, *J* = 252.6 Hz), 136.4, 132.2, 132.0, 119.7 (dd, *J* = 259.1, 247.7 Hz), 118.4, 113.2, 111.5 (m), 75.8 (dd, *J* = 29.7, 21.5 Hz), 46.8.

^{19}F NMR (282 MHz, $CDCl_3$) δ: -89.4 (dt, *J* = 274.5 Hz, 23.6 Hz, 1F), -103.3 (dq, *J* = 275.3, 24.1 Hz, 1F), -140.9-(-140.3) (m, 2F), -151.0 (t, *J* = 21.0 Hz, 1F), -161.1-(-161.5) (m, 2F).

HRMS (ESI): calcd for $C_{16}H_{10}F_7N_2O$ (M+H) 379.0676; found 379.0662.

***N*-Phenyl-*N*-(2,2,2-trifluoro-1-phenylethyl)hydroxylamine (3t).[13]**



[13] Nelson, D. W.; Owens, J.; Hiraldo, D. *J. Org. Chem.* **2001**, *66*, 2572–2582.

Yield 89 mg (67%). Colorless crystals. Mp 77–78 °C. Chromatography: hexanes/EtOAc, 7/1. R_f 0.41 (hexanes/EtOAc, 5/1).

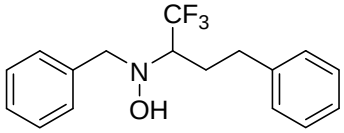
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.45–7.28 (m, 7H), 7.15–7.05 (m, 3H), 5.46 (s, 1H), 4.96 (q, *J* = 8.2 Hz, 1H)

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 150.5, 130.4, 129.4, 129.2, 128.9, 128.2, 125.1 (q, J = 282.4 Hz), 123.6, 118.0, 72.9 (q, *J* = 29.0 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ: –69.6 (d, *J* = 8.2 Hz).

HRMS (ESI): calcd for $C_{14}H_{13}F_3NO$ (M+H) 268.0944; found 268.0943.

_N_-Benzyl-_N_-(1,1,1-trifluoro-4-phenylbutan-2-yl)hydroxylamine (3u).



Yield 115 mg (74%). Colorless oil. Chromatography: hexanes/EtOAc, 7/1. R_f 0.42 (hexanes/EtOAc, 5/1).

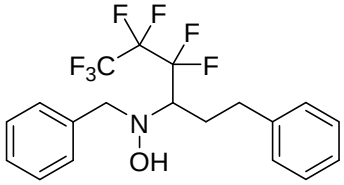
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.48-7.31 (m, 10H), 5.31 (s, 1H), 4.05 (m, 2H), 3.39-3.27 (m, 1H), 2.94 (t, *J* = 7.6 Hz, 2H), 2.42-2.30 (m, 1H), 2.26-2.14 (m, 1H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 141.0, 137.3, 129.4, 128.7, 128.6, 128.6, 127.7, 126.4 (*J* = 285.7 Hz), 126.4, 64.8 (q, *J* = 25.7 Hz), 61.2, 32.7, 26.0.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –70.1 (d, *J* = 8.0 Hz).

HRMS (ESI): calcd for $C_{17}H_{19}F_3NO$ (M+H) 310.1413; found 310.1419.

_N_-benzyl-_N_-(4,4,5,5,6,6,6-heptafluoro-1-phenylhexan-3-yl)hydroxylamine (3v).



Yield 159 mg (78%). Colorless oil. Chromatography: hexanes/EtOAc, 10/1. R_f 0.36 (hexanes/EtOAc, 10/1).

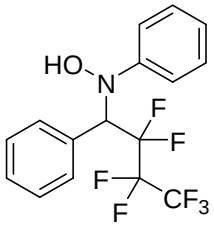
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.46–7.30 (m, 10H), 4.78 (s, 1H), 4.06 (d, *J* = 13.2 Hz, 1H), 3.79 (d, *J* = 13.2 Hz, 1H), 3.55 (m, 1H), 2.96 (m, 2H), 2.41 (m, 2H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 141.1, 137.2, 129.3, 128.8, 128.7, 128.5, 127.7, 126.5, 64.2 (dd, *J* = 25.9, 19.7 Hz), 61.9, 33.9 (d, *J* = 3.1 Hz), 23.8.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –81.4 (dd, *J* = 13.2, 8.2 Hz, 3F), –113.0 (dm, *J* = 286.3 Hz, 1F), –112.4 (dm, *J* = 286.3 Hz, 1F), –124.3 (ddd, *J* = 289.9, 13.6, 9.1 Hz, 1F), –128.0 (dd, *J* = 289.9, 14.5 Hz, 1F).

HRMS (ESI): calcd for $C_{19}H_{18}F_7NONa$ (M+Na) 432.1169; found 432.1161.

***N*-(2,2,3,3,4,4,4-heptafluoro-1-phenylbutyl)-*N*-phenylhydroxylamine (3w).**



Yield 133 mg (72%). Colorless crystals. Mp 56–58 °C. Chromatography: hexanes/EtOAc, 10/1. R_f 0.38 (hexanes/EtOAc, 10/1).

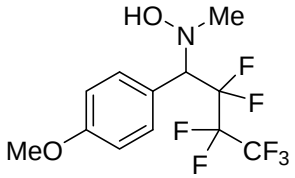
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.47–7.26 (m, 7H), 7.14–7.03 (m, 3H), 5.26 (s, 1H), 5.07 (dd, *J* = 20.7, 9.3 Hz, 1H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 150.3, 131.5, 129.3, 128.9, 128.5, 128.1, 123.6, 117.9, 70.8 (dd, *J* = 27.7, 18.4 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ: –81.4 (t, *J* = 10.7 Hz, 3F), –112.2 (dm, *J* = 285.3, 1F), –118.2 (dm, *J* = 285.3 Hz, 1F), –125.2 (ddd, *J* = 289.9, 13.6, 6.5 Hz, 1F), –127.2 (dd, *J* = 289.9, 14.5 Hz, 1F).

HRMS (ESI): calcd for $C_{16}H_{12}F_7NONa$ (M+H) 390.0699; found 390.0704.

***N*-(2,2,3,3,4,4,4-Heptafluoro-1-(4-methoxyphenyl)butyl)-*N*-methylhydroxylamine (3x)**



Yield 146 mg (87%). Colorless crystals. Mp 35–37 °C. Chromatography: hexanes/EtOAc, 5/1. R_f 0.26 (hexanes/EtOAc, 5/1).

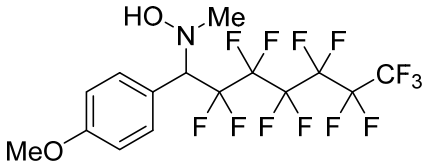
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.44 (d, *J* = 8.6 Hz, 2H), 6.94 (d, *J* = 8.6 Hz, 2H), 5.67 (s, 1H), 4.20 (dd, *J* = 17.2, 12.3 Hz, 1H), 3.83 (s, 3H), 2.53 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 160.5, 133.1, 120.8, 113.8, 70.4 (dd, *J* = 24.6, 18.5 Hz), 55.3, 45.9.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –81.6 (t, *J* = 10.7 Hz, 3F), –113.9 (d, *J* = 282.7 Hz, 1F), –118.5 (d, *J* = 282.7 Hz, 1F), –126.2 (dd, *J* = 11.4, 6.4 Hz, 2F).

HRMS (ESI): calcd for $C_{12}H_{10}F_7NO_2Na$ (M+H) 356.0492; found 356.0495.

***N*-Methyl-*N*-(2,2,3,3,4,4,5,5,6,6,7,7,7-tridecafluoro-1-(4-methoxyphenyl)heptyl)hydroxylamine (3y)**



Yield 209 mg (86%). Colorless crystals. Mp 63–66 °C. Chromatography: hexanes/EtOAc, 5/1. R_f 0.33 (hexanes/EtOAc, 5/1).

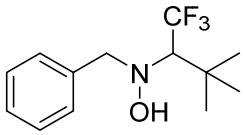
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.45 (d, *J* = 8.7 Hz, 2H), 6.94 (d, *J* = 8.7 Hz, 2H), 5.67 (br. s, 1H), 4.22 (dd, *J* = 17.4, 12.4 Hz, 1H), 3.83 (s, 3H), 2.53 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 160.5, 133.1, 120.8, 113.8, 70.6 (dd, *J* = 24.6, 18.3 Hz), 55.3, 45.9.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –81.9 (t, *J* = 10.1 Hz, 3F), –113.4 (dm, *J* = 283.8 Hz, 1F), –117.5 (dm, *J* = 283.8 Hz, 1F), –121.8 (m, 2F), –122.8 (m, 2F), –123.7 (m, 2F), –127.2 (m, 2F).

HRMS (ESI): calcd for $C_{15}H_{13}F_{13}NO_2$ (M+H) 486.0733; found 486.0723.

***N*-Benzyl-*N*-(1,1,1-trifluoro-3,3-dimethylbutan-2-yl)hydroxylamine (3z).**



Yield 69 mg (53%). Colorless oil. Chromatography: hexanes/EtOAc, 10/1. R_f 0.32 (hexanes/EtOAc, 10/1).

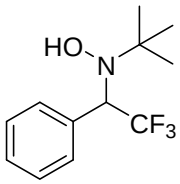
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.41–7.31 (m, 5H), 4.71 (br. s, 1H), 4.38 (d, *J* = 13.4 Hz, 1H), 3.99 (d, *J* = 13.4 Hz, 1H), 3.05 (q, *J* = 9.2 Hz, 1H), 1.13 (s, 9H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 138.3, 129.4, 128.6, 127.7, 127.1 (q, *J* = 291.4 Hz), 73.7 (q, *J* = 22.4 Hz), 64.3, 35.0, 28.3.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –59.7 (d, *J* = 9.2 Hz).

HRMS (ESI): calcd for $C_{13}H_{19}F_3NO$ (M+H) 262.1413; found 262.1419.

***N*-(*tert*-Butyl)-*N*-(2,2,2-trifluoro-1-phenylethyl)hydroxylamine (3π).**



Yield 49 mg (40%). Colorless oil. Chromatography: hexanes/EtOAc, 8/1. R_f 0.20 (hexanes/EtOAc, 10/1).

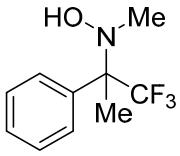
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.64-7.58 (m, 2H), 7.41-7.35 (m, 3H), 4.72 (br s, 1H), 4.52 (q, *J* = 8.6 Hz, 1H), 1.07 (s, 9H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 132.6, 131.4, 128.5, 127.8, 125.3 (q, *J* = 281.9 Hz), 65.1 (q, *J* = 28.1 Hz), 60.1, 26.5.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –71.5 (d, *J* = 8.6 Hz).

HRMS (ESI): calcd for $C_{12}H_{17}F_3NO$ (M+H) 248.1257; found 248.1255.

***N*-methyl-*N*-(1,1,1-trifluoro-2-phenylpropan-2-yl)hydroxylamine (3σ).**



Yield 57 mg (52%). Colorless crystals. Mp 73–74 °C. Chromatography: hexanes/EtOAc, 5/1. R_f 0.34 (hexanes/EtOAc, 5/1).

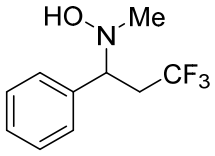
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.63–7.58 (m, 2H), 7.42–7.34 (m, 3H), 5.46 (s, 1H), 2.47 (s, 3H), 1.75 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 137.6, 128.8, 128.5, 128.0, 126.4 (q, *J* = 285.8 Hz), 70.7 (q, *J* = 24.5 Hz), 41.2, 10.4.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –73.4.

HRMS (ESI): calcd for $C_{10}H_{13}F_3NO$ (M+H) 220.0944; found 220.0953.

_N_-Methyl-_N_-(3,3,3-trifluoro-1-phenylpropyl)hydroxylamine (6a).



Yield 90 mg (82%). Colorless crystals. Mp 76–79 °C. Chromatography: hexanes/EtOAc, 3/1. R_f 0.19 (hexanes/EtOAc, 4/1).

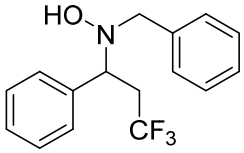
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.42–7.31 (s, 5H), 3.86 (dd, *J* = 9.3, 4.1 Hz, 1H), 3.21-3.03 (m, 1H), 2.75-2.61 (m, 1H), 2.48 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 137.7, 128.8, 128.8, 128.6, 126.4 (q, *J* = 276.8 Hz), 68.0, 46.1, 37.6 (q, *J* = 27.2 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ: -63.8 (t, *J* = 10.4 Hz).

HRMS (ESI): calcd for $C_{10}H_{13}F_3NO$ (M+H) 220.0944; found 220.0946.

_N_-Benzyl-_N_-(3,3,3-trifluoro-1-phenylpropyl)hydroxylamine (6b).



Yield 117 mg (79%). Colorless oil. Chromatography: hexanes/EtOAc, 8/1. R_f 0.35 (hexanes/EtOAc, 8/1).

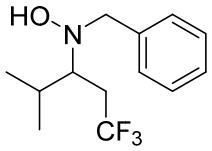
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.53–7.30 (m, 10H), 5.41 (s, 1H), 4.10 (dd, *J* = 8.4, 5.1 Hz, 1H), 3.70 (d, *J* = 13.2 Hz, 1H), 3.58 (d, *J* = 13.2 Hz, 1H), 3.23–3.05 (m, 1H), 2.73–2.55 (m, 1H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 137.8, 137.6, 129.5, 129.0, 128.7, 128.5, 128.4, 127.6, 126.2 (q, *J* = 227.2 Hz), 65.7, 61.5, 37.6 (q, *J* = 26.9 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ: –63.5 (t, *J* = 10.5 Hz).

HRMS (ESI): calcd for $C_{16}H_{17}F_3NO$ (M+H) 296.1257; found 296.1257.

_N_-Benzyl-_N_-(1,1,1-trifluoro-4-methylpentan-3-yl)hydroxylamine (6c).



Yield 98 mg (75%). Colorless crystals. Mp 57–59 °C. Chromatography: hexanes/EtOAc, 10/1. R_f 0.52 (hexanes/EtOAc, 5/1).

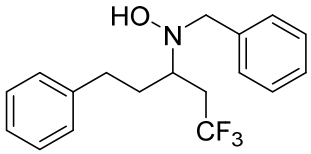
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.41–7.28 (m, 5H), 4.41 (br s, 1H), 3.87 (q, *J* = 12.6 Hz, 2H), 2.90-2.71 (m, 2H), 2.30–2.11 (m, 2H), 2.00 (sextet, *J* = 6.8 Hz, 1H), 1.06 (d, *J* = 6.8 Hz, 3H), 1.02 (d, *J* = 6.8 Hz, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 138.2, 129.3, 128.5, 127.5 (q, *J* = 276.0 Hz), 127.5, 65.3, 62.0, 31.2, 30.7 (q, *J* = 27.9 Hz), 20.1, 19.6.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –63.9 (t, *J* = 11.5 Hz).

HRMS (ESI): calcd for $C_{13}H_{19}F_3NO$ (M+H) 262.1413; found 262.1419.

_N_-Benzyl-_N_-(1,1,1-trifluoro-5-phenylpentan-3-yl)hydroxylamine (6d).



Yield 100 mg (62%). Colorless oil. Chromatography: hexanes/EtOAc, 10/1. R_f 0.28 (hexanes/EtOAc, 10/1).

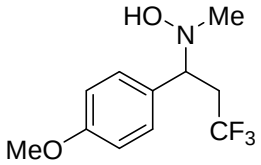
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.45-7.25 (m, 10H), 5.18 (br s, 1H), 3.88 (q, *J* = 12.9 Hz, 2H), 3.17-3.08 (m, 1H), 3.93–3.73 (m, 3H), 2.35-2.10 (s, 2H), 2.05–1.92 (s, 1H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 141.7, 137.6, 129.5, 128.6, 128.5, 127.6, 127.2 (q, *J* = 276.6 Hz), 126.1, 60.5, 59.5 (q, *J* = 2.1 Hz), 33.3 (q, *J* = 27.4 Hz), 33.3, 32.6.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –64.0 (t, *J* = 11.5 Hz),

HRMS (ESI): calcd for $C_{18}H_{21}F_3NO$ (M+H) 324.1570; found 324.1568.

_N_-Methyl-_N_-(3,3,3-trifluoro-1-(4-methoxyphenyl)propyl)hydroxylamine (6e).



Yield 70 mg (56%). Colorless crystals. Mp 101–102 °C. Chromatography: hexanes/EtOAc, 3/1. R_f 0.25 (hexanes/EtOAc, 3/1).

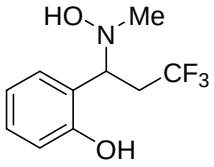
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.22 (d, *J* = 8.6 Hz, 2H), 6.89 (d, *J* = 8.6 Hz, 2H), 3.80 (s, 4H), 3.07 (m, 1H), 2.61 (m, 1H), 2.45 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 159.7, 129.9, 129.6, 126.4 (q, *J* = 276.6 Hz), 114.1, 67.2, 55.3, 45.9, 37.4 (q, *J* = 27.1 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ: –63.7 (t, *J* = 10.2 Hz).

HRMS (ESI): calcd for $C_{11}H_{15}F_3NO_2$ (M+H) 250.1049; found 250.1052.

2-(3,3,3-trifluoro-1-(hydroxy(methyl)amino)propyl)phenol (6f)



Yield 86 mg (73%). Yellow oil. Chromatography: hexanes/EtOAc, 2/1. R_f 0.34 (hexanes/EtOAc, 2/1).

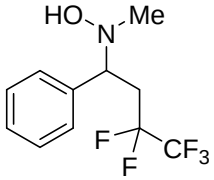
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.61 (br. s, 2H), 7.33-7.27 (m, 1H), 7.13 (d, *J* = 7.4 Hz, 1H), 6.98-6.91 (m, 2H), 4.04 (d, *J* = 7.0 Hz, 1H), 3.23-3.06 (m, 1H), 2.80-2.71 (m, 1H), 2.71 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 154.8, 130.2, 130.0, 126.1 (q, *J* = 276.7 Hz), 123.7, 120.6, 117.4, 68.1, 46.0, 35.8 (q, *J* = 28.1 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ: -63.7 (br s).

HRMS (ESI): calcd for $C_{10}H_{13}F_3NO_2$ (M+H) 236.0893; found 236.0890.

***N*-Methyl-*N*-(3,3,4,4,4-pentafluoro-1-phenylbutyl)hydroxylamine (6g).**



Yield 106 mg (78%). Colorless crystals. Mp 60–61 °C. Chromatography: hexanes/EtOAc, 4/1. R_f 0.20 (hexanes/EtOAc, 5/1).

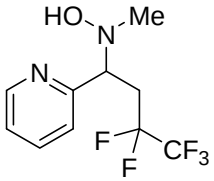
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.41-7.31 (m, 5H), 7.04 (br s, 1H), 3.97 (dd, *J* = 9.0, 3.9 Hz, 1H), 3.12-2.97 (m, 1H), 2.72-2.54 (m, 1H), 2.47 (s, 3H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 138.1, 128.8, 128.8, 128.6, 119.2 (qt, *J* = 285.5, 36.0 Hz), 115.5 (tq, *J* = 253.7, 37.7 Hz), 66.8, 46.0, 34.0 (t, *J* = 20.1 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ: –86.8 (s, 3F), –116.2 (br d, *J* = 266.6 Hz, 1F), –118.4 (ddd, *J* = 266.6, 27.7, 8.2 Hz, 1F).

HRMS (ESI): calcd for $C_{11}H_{13}F_5NO$ (M+H) 270.0912; found 270.0914.

***N*-Methyl-*N*-(3,3,4,4,4-pentafluoro-1-(pyridin-2-yl)butyl)hydroxylamine (6h).**



Yield 92 mg (68%). Colorless oil. Chromatography: hexanes/EtOAc, 1/1. R_f 0.30 (hexanes/EtOAc, 1/1).

^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.59 (ddd, *J* = 4.9, 1.8, 0.9 Hz, 1H), 7.70 (td, *J* = 7.8, 1.8 Hz, 1H), 7.31 (dt, *J* = 7.8, 1.1 Hz, 1H), 7.25 (ddd, *J* = 7.8, 4.9, 1.2 Hz, 1H), 4.21–4.16 (m, 1H), 3.05–2.89 (m, 1H), 2.52 (s, 3H).

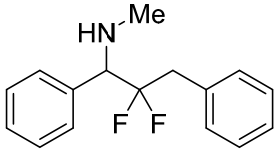
^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 158.2, 149.3, 137.0, 124.4, 123.3, 118.9 (qt, *J* = 285.3, 35.9 Hz), 115.7 (tq, *J* = 253.0, 37.8 Hz), 65.9, 45.3, 32.4 (t, *J* = 20.2 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ: –86.8 (s, 3F), –116.4 (ddd, *J* = 265.0, 25.4, 13.2 Hz, 1F), -118.0 (ddd, *J* = 265.0, 25.3, 13.7 Hz, 1F).

HRMS (ESI): calcd for $C_{10}H_{12}F_5N_2O$ (M+H) 271.0864; found 271.0869.

Reduction of hydroxylamines 3a,b and 6b (General Procedure). Acetic acid (2 mL) and concentrated hydrochloric acid (80 µL) were added to a test tube containing fluorine-substituted hydroxylamine (0.50 mmol) and zinc dust (195 mg, 3.0 mmol), and the mixture was stirred for 24 h under air atmosphere at room temperature. The reaction mixture was poured portionwise into a solution of potassium hydroxide (1.9 g) in water (10 mL). The mixture was washed with MTBE (3×4 mL). The combined organic phases were washed with saturated aqueous $NaHCO_3$ solution, dried over Na_2SO_4, concentrated, and the residue was dried under vacuum.

2,2-Difluoro-*N*-methyl-1,3-diphenylpropan-1-amine (7a).



Yield 130 mg (100%). Colorless oil.

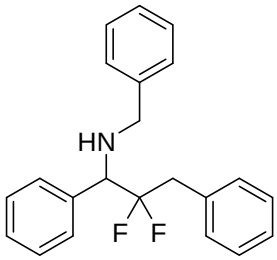
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.45–7.29 (m, 10H), 3.78 (dd, *J* = 14.1, 10.1 Hz, 1H), 3.51–3.33 (m, 1H), 3.11 (ddd, *J* = 26.5, 14.4, 12.1 Hz, 1H), 2.34 (s, 3H), 1.79 (s, 1H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 136.4 (t, *J* = 1.9 Hz), 133.2 (dd, J = 4.5, 2.9 Hz), 130.7, 129.0 (t, *J* = 1.3 Hz), 128.5, 128.3, 128.3, 127.2, 123.5 (t, *J* = 247.2 Hz), 68.0 (dd, *J* = 25.5, 24.4 Hz), 40.2 (t, *J* = 24.8 Hz), 34.3.

^{19}F NMR (282 MHz, $CDCl_3$) δ: -106.0 (dddd, *J* = 247.8, 26.6, 15.8, 10.7 Hz), -105.2 (ddt, *J* = 247.8, 20.4, 13.2 Hz)

HRMS (ESI): calcd for $C_{16}H_{18}F_2N$ (M+H) 262.1402; found 262.1396.

***N*-Benzyl-2,2-difluoro-1,3-diphenylpropan-1-amine (7b).**



Yield 163 mg (97%). Colorless oil.

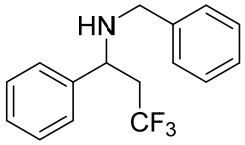
^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.54–7.34 (m, 15H), 4.01 (dd, *J* = 16.5, 7.7 Hz, 1H), 3.86 (d, *J* = 13.1 Hz, 1H), 3.64 (d, *J* = 13.1 Hz, 1H), 3.54 (ddd, *J* = 31.2, 16.7, 14.5 Hz, 1H), 3.27 (ddd, *J* = 24.1, 14.6, 10.1 Hz, 1H), 2.18 (br s, 1H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 139.8, 136.5, 133.3 (dd, *J* = 5.6, 2.0 Hz), 130.7, 129.1 (t, *J* = 1.2 Hz), 128.5, 128.5, 128.4, 128.3, 127.3, 127.2, 123.5 (t, *J* = 247.0 Hz), 65.1 (dd, *J* = 26.8, 24.3 Hz), 51.1, 40.2 (dd, *J* = 25.2, 24.2 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ: –104.0 (dddd, *J* = 248.6, 22.3, 16.5, 8.1 Hz, 1F), –106.5 (dddd, *J* = 248.6, 25.8, 15.7, 10.1 Hz, 1F).

HRMS (ESI): calcd for $C_{22}H_{22}F_2N$ (M+H) 338.1715; found 338.1709.

3,3,3-Trifluoro-*N*-methyl-1-phenylpropan-1-amine (7c).



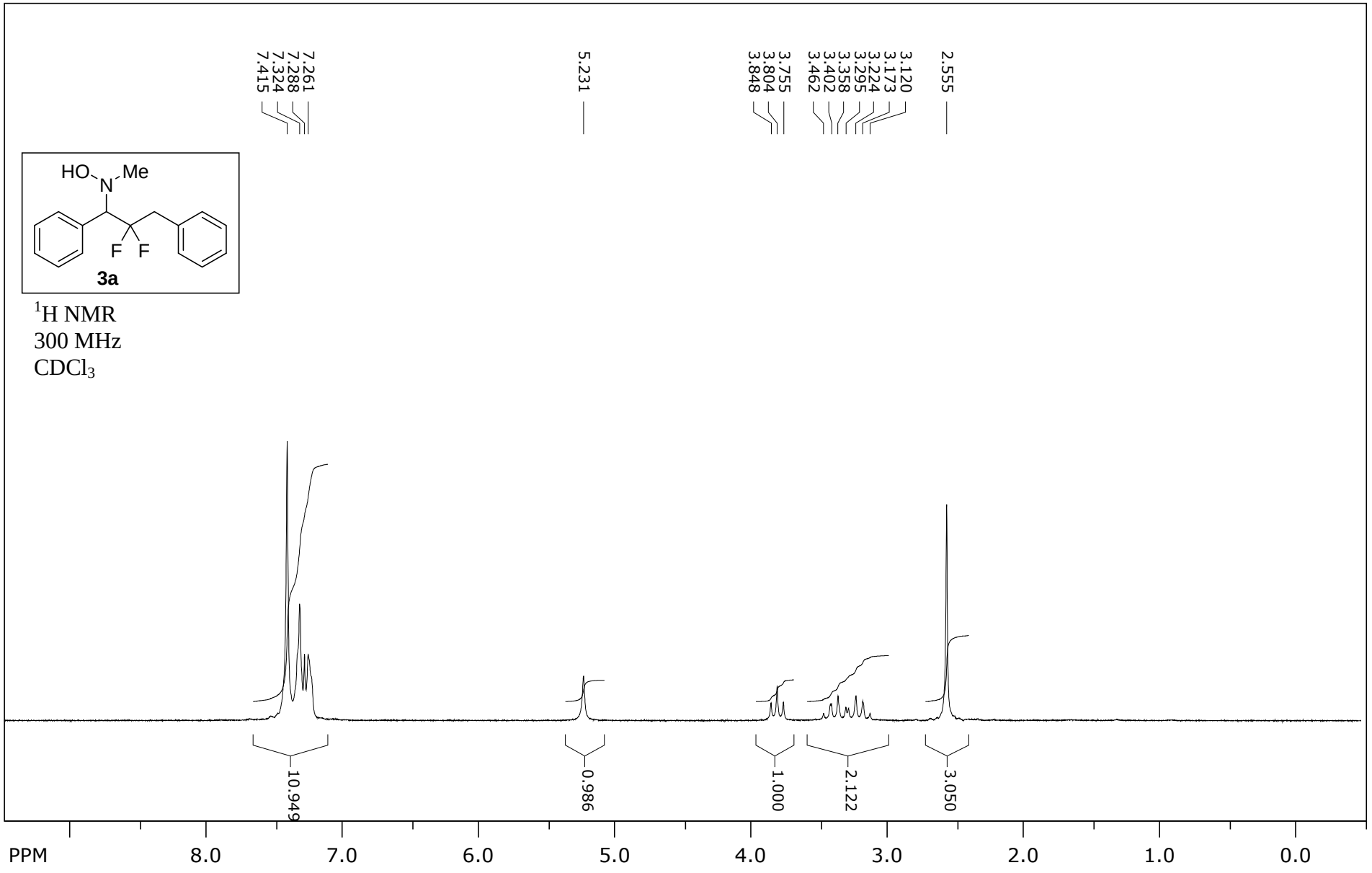
Yield 94 mg (93%). Colorless oil.

^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.40–7.27 (m, 5H), 3.86 (dd, *J* = 7.4, 5.6 Hz, 1H), 2.62–2.37 (m, 2H), 2.27 (s, 3H), 1.66 (br. s, 1H).

^{13}C NMR (75.5 MHz, $CDCl_3$) δ: 141.6, 128.9, 128.0, 127.2, 126.3 (q, *J* = 277.4 Hz), 59.5 (q, *J* = 2.8 Hz), 41.7 (q, *J* = 26.9 Hz), 34.1.

^{19}F NMR (282 MHz, $CDCl_3$) δ: –64.2 (t, *J* = 10.8 Hz).

HRMS (ESI): calcd for $C_{10}H_{13}F_3N$ (M+H) 204.0995; found 204.0999.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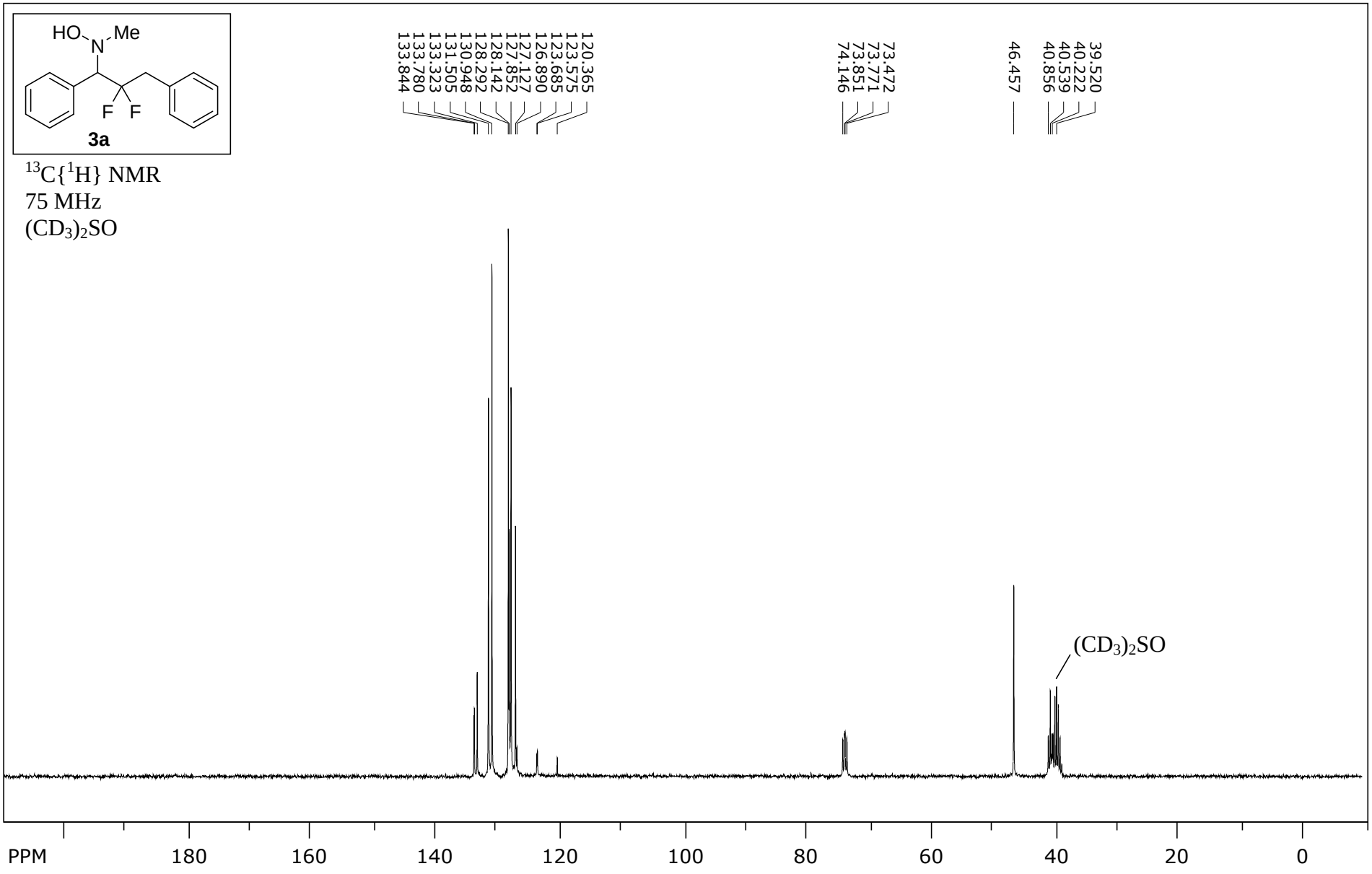
7.261
5.231
3.848
3.804
3.755
3.462
3.402
3.358
3.295
3.224
3.173
3.120
2.555
HO
N
Me
F
F
3a
1H NMR
300 MHz
CDCl3
10.949
0.986
1.000
2.122
3.050
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0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N
Me
F F
3a
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133.323
131.505
130.948
128.292
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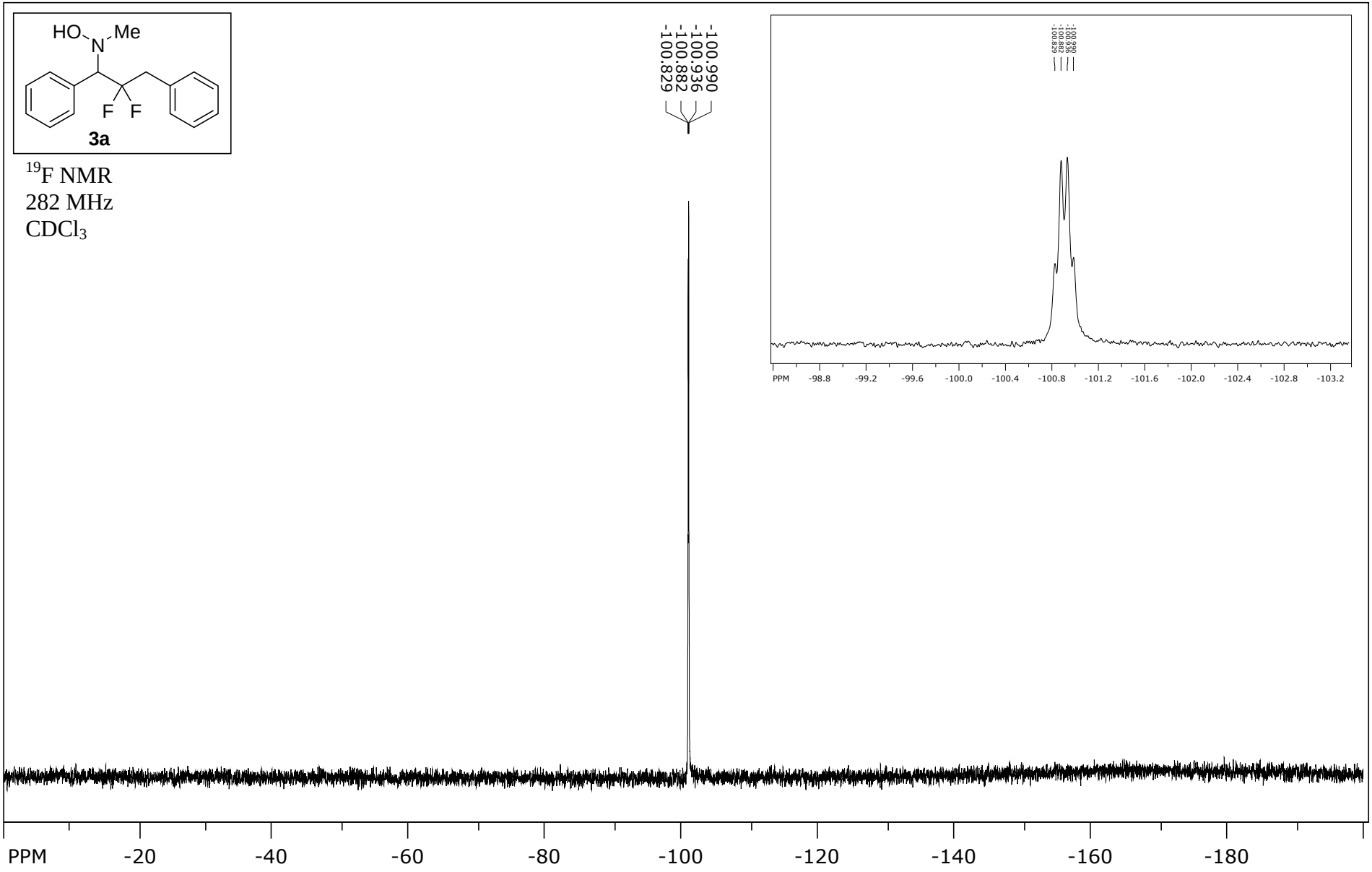
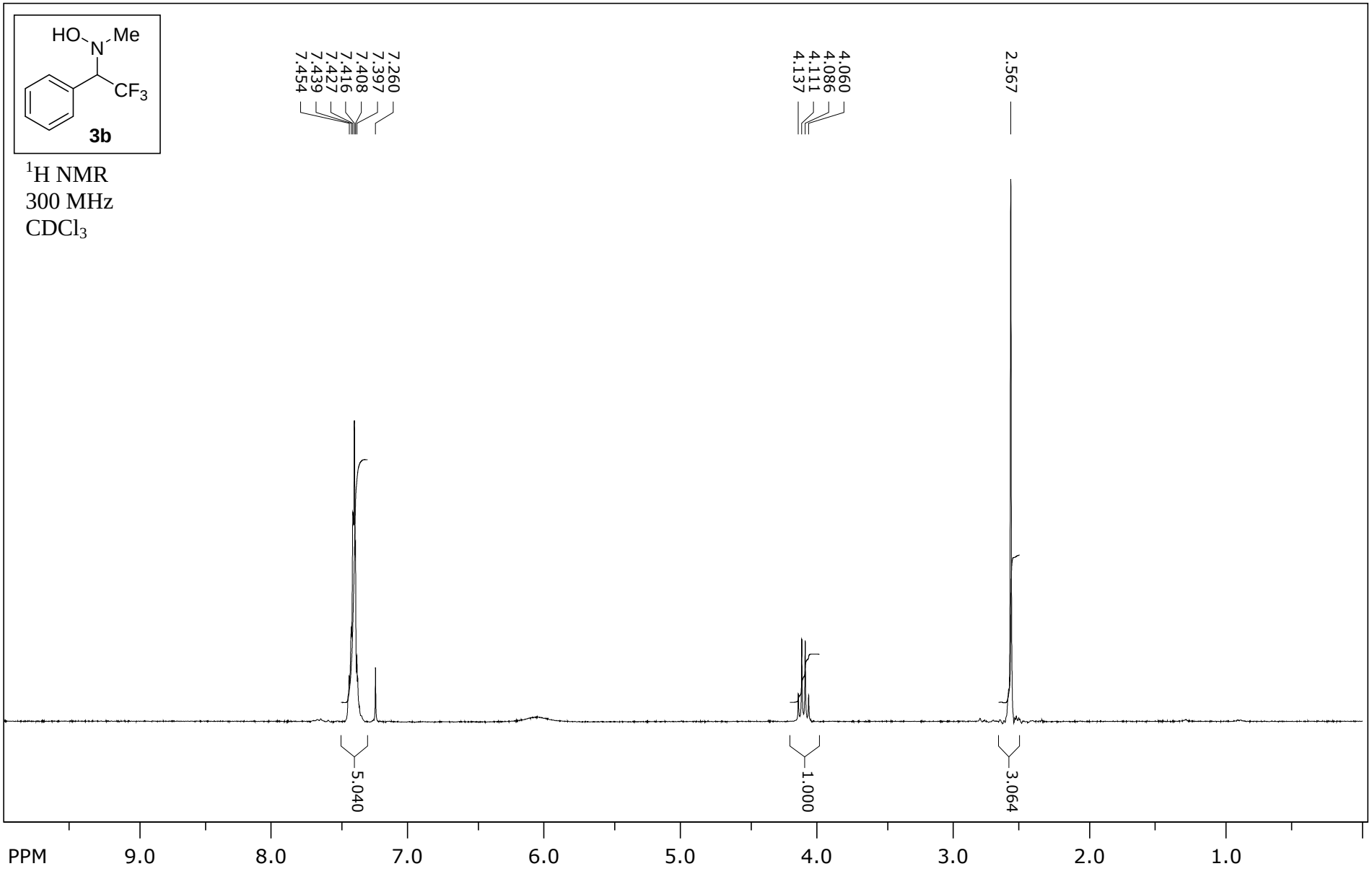
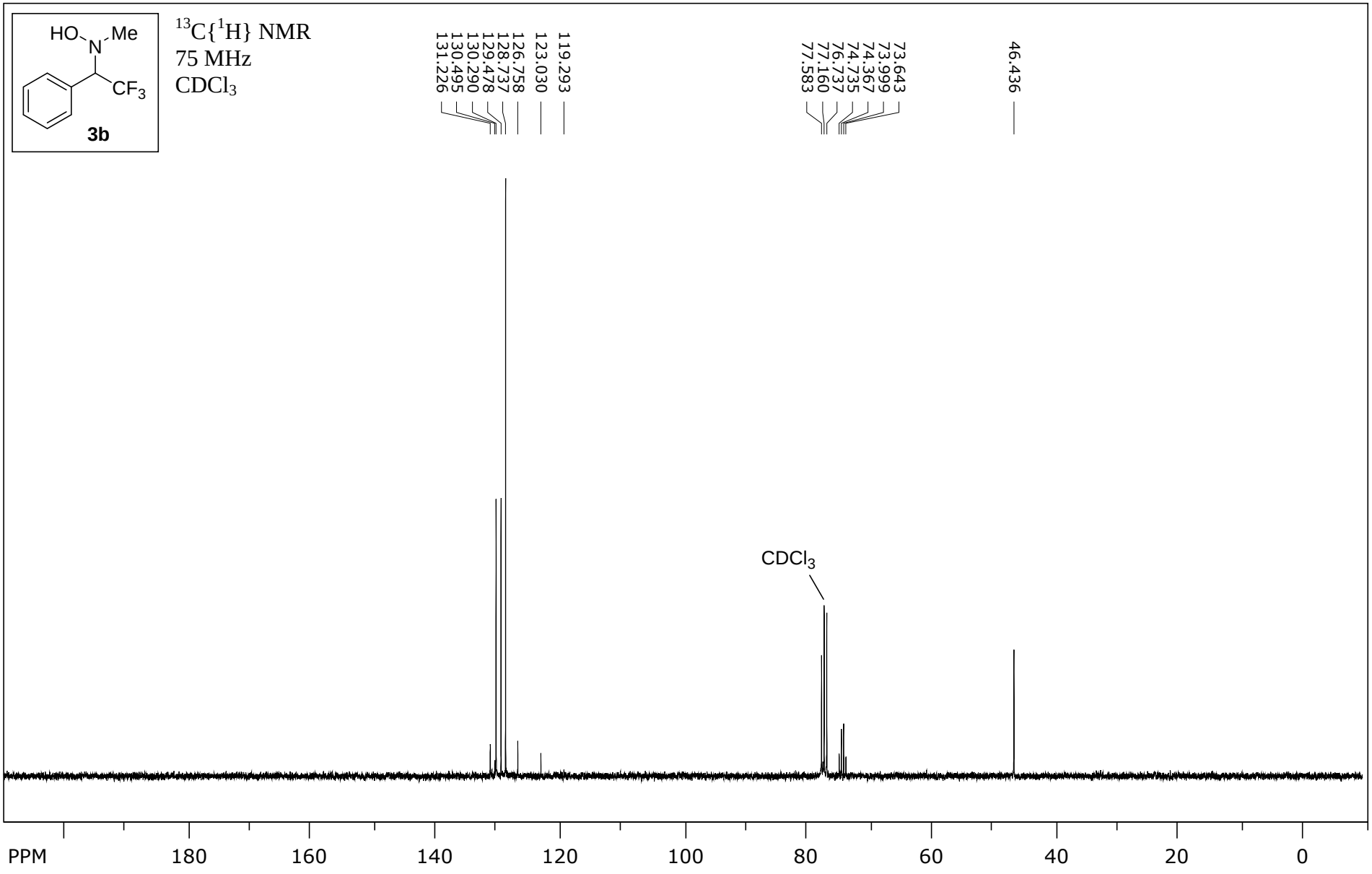
126.890
123.685
123.575
120.365
74.146
73.851
73.771
73.472
46.457
40.856
40.539
40.222
39.520
$^{13}C\{^{1}H\}$ NMR
75 MHz
$(CD_3)_2SO$
$(CD_3)_2SO$
PPM
180
160
140
120
100
80
60
40
20
0


HO
N
Me
F F
3a
^{19}F NMR
282 MHz
$CDCl_3$
-100.990
-100.936
-100.882
-100.829
PPM -98.8 -99.2 -99.6 -100.0 -100.4 -100.8 -101.2 -101.6 -102.0 -102.4 -102.8 -103.2
PPM -20 -40 -60 -80 -100 -120 -140 -160 -180



^{1}H NMR
300 MHz
$CDCl_3$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N
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3b
13C{1H} NMR
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CDCl3
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77.160
76.737
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140
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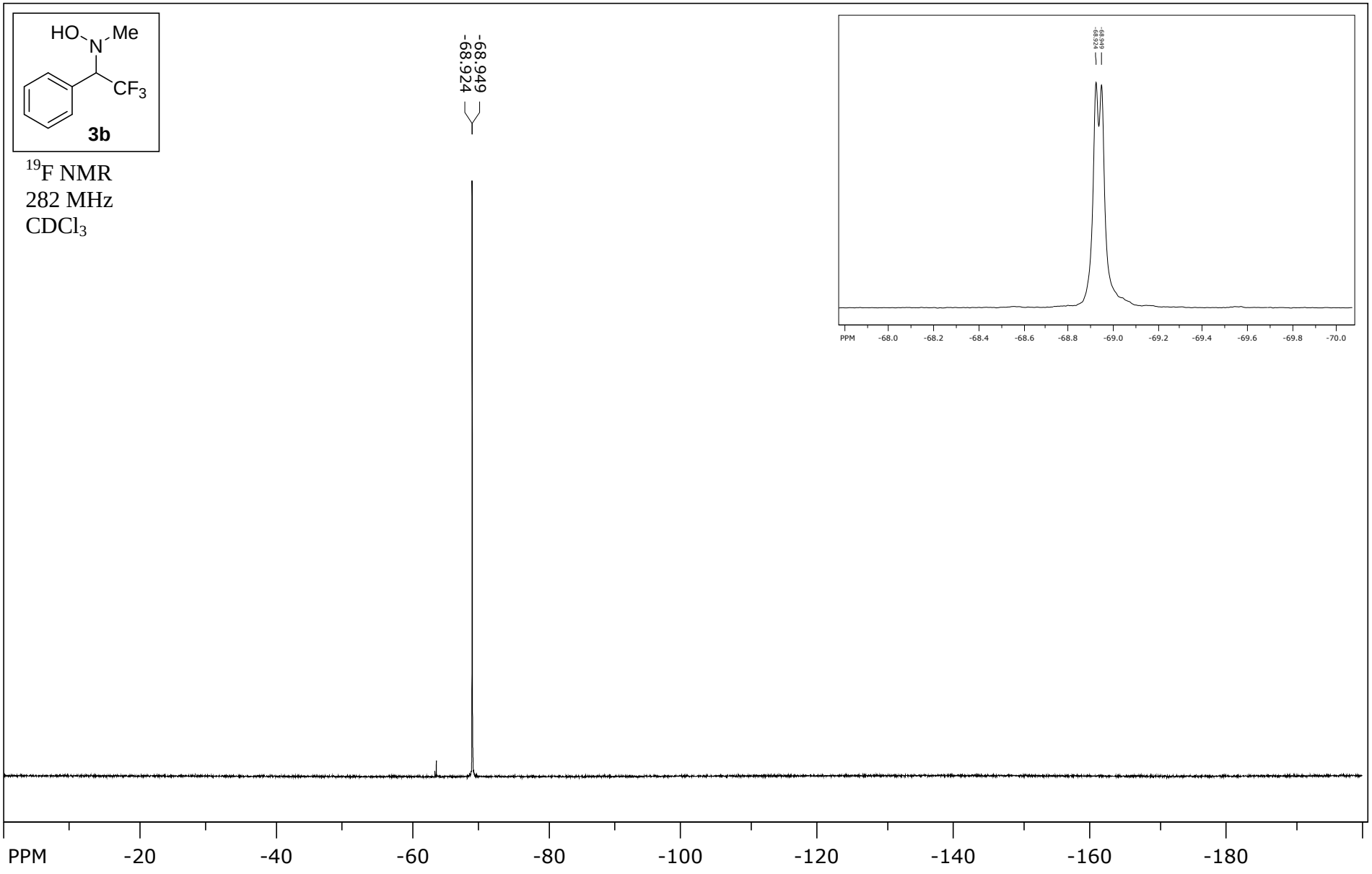
80
60
40
20
0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CDCl3
PPM
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-40
-60
-80
-100
-120
-140
-160
-180
PPM
-68.0
-68.2
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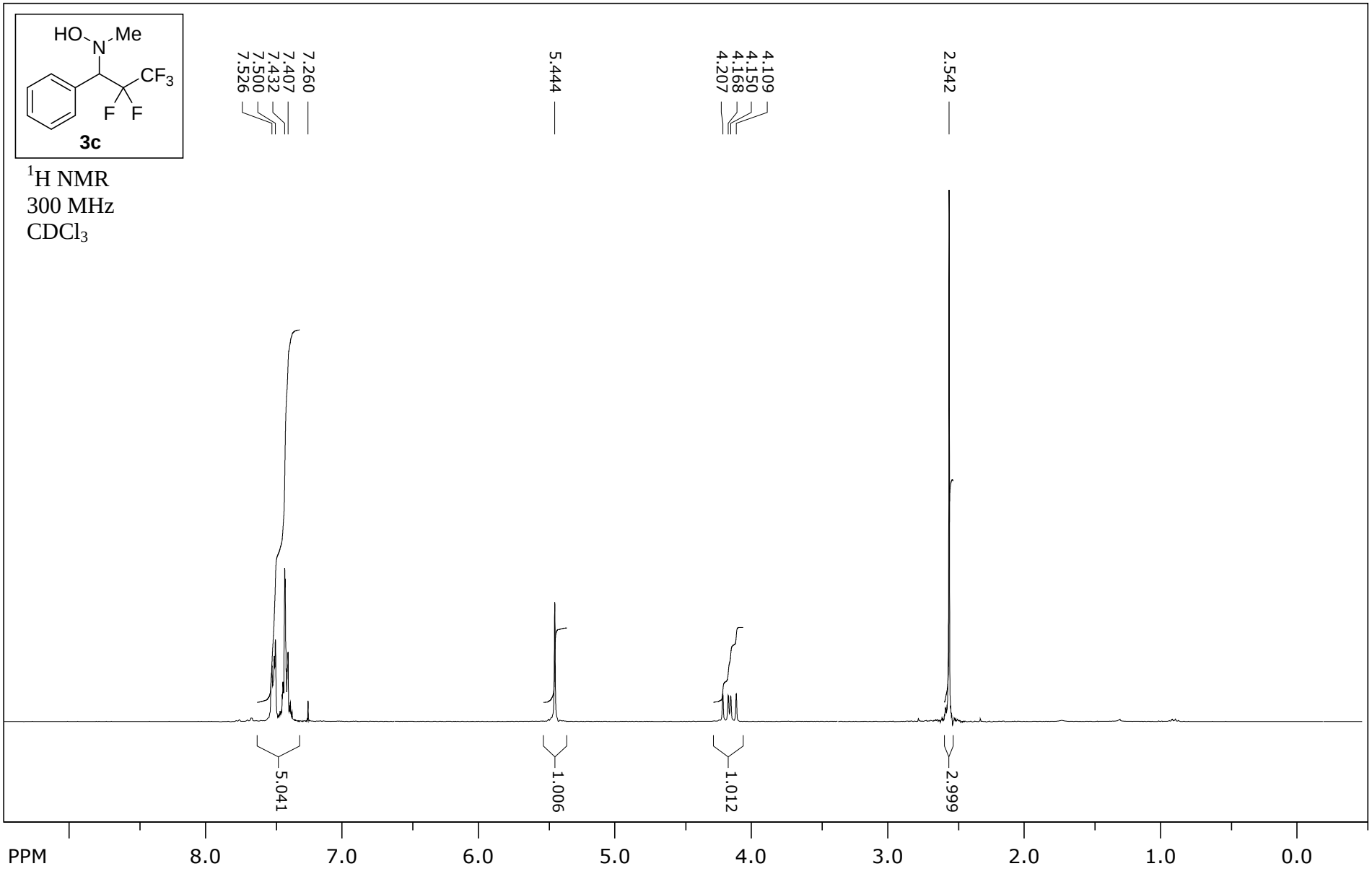
-68.8
-69.0
-69.2
-69.4
-69.6
-69.8
-70.0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Me
CF3
F F
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CDCl3
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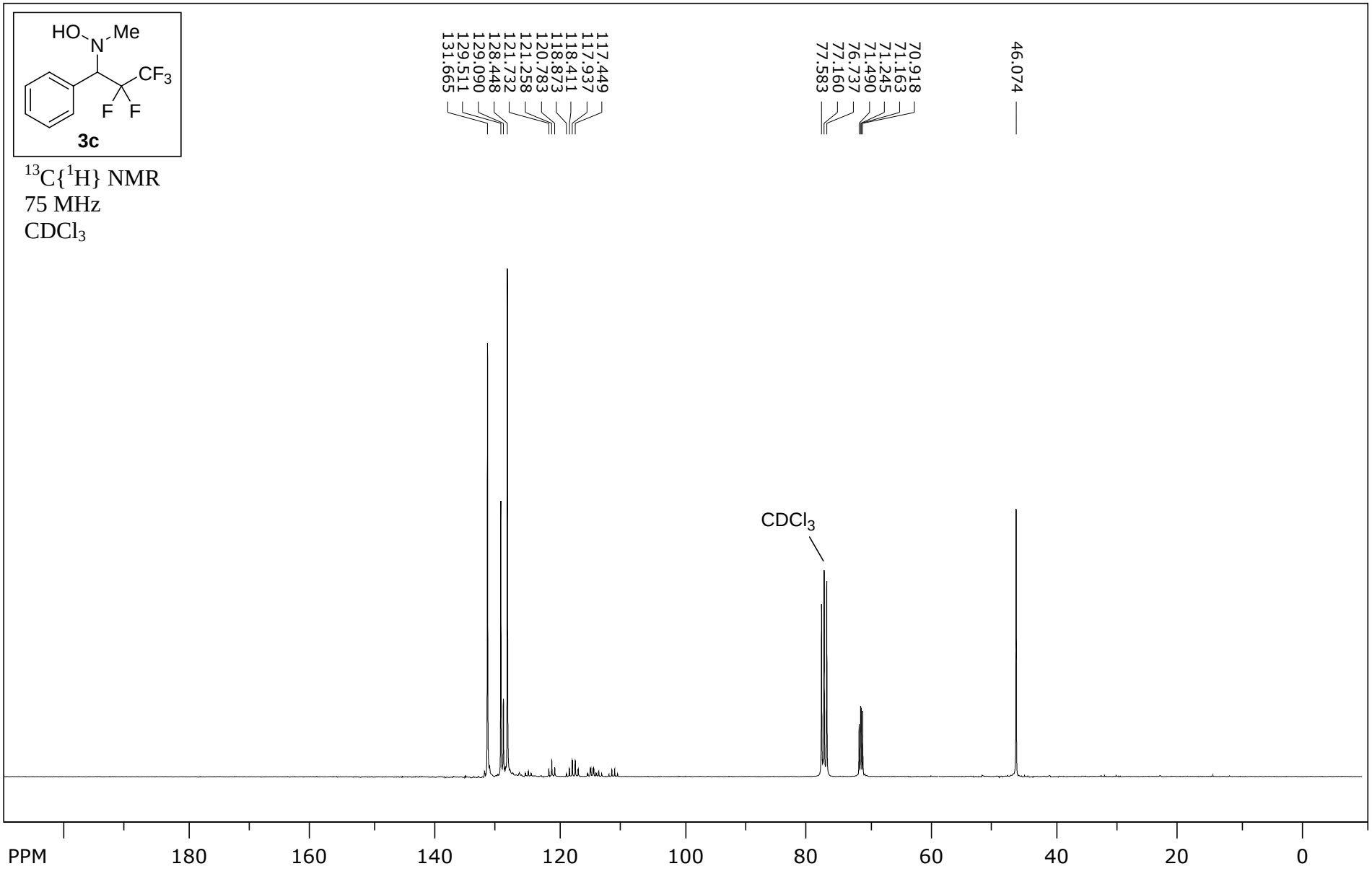
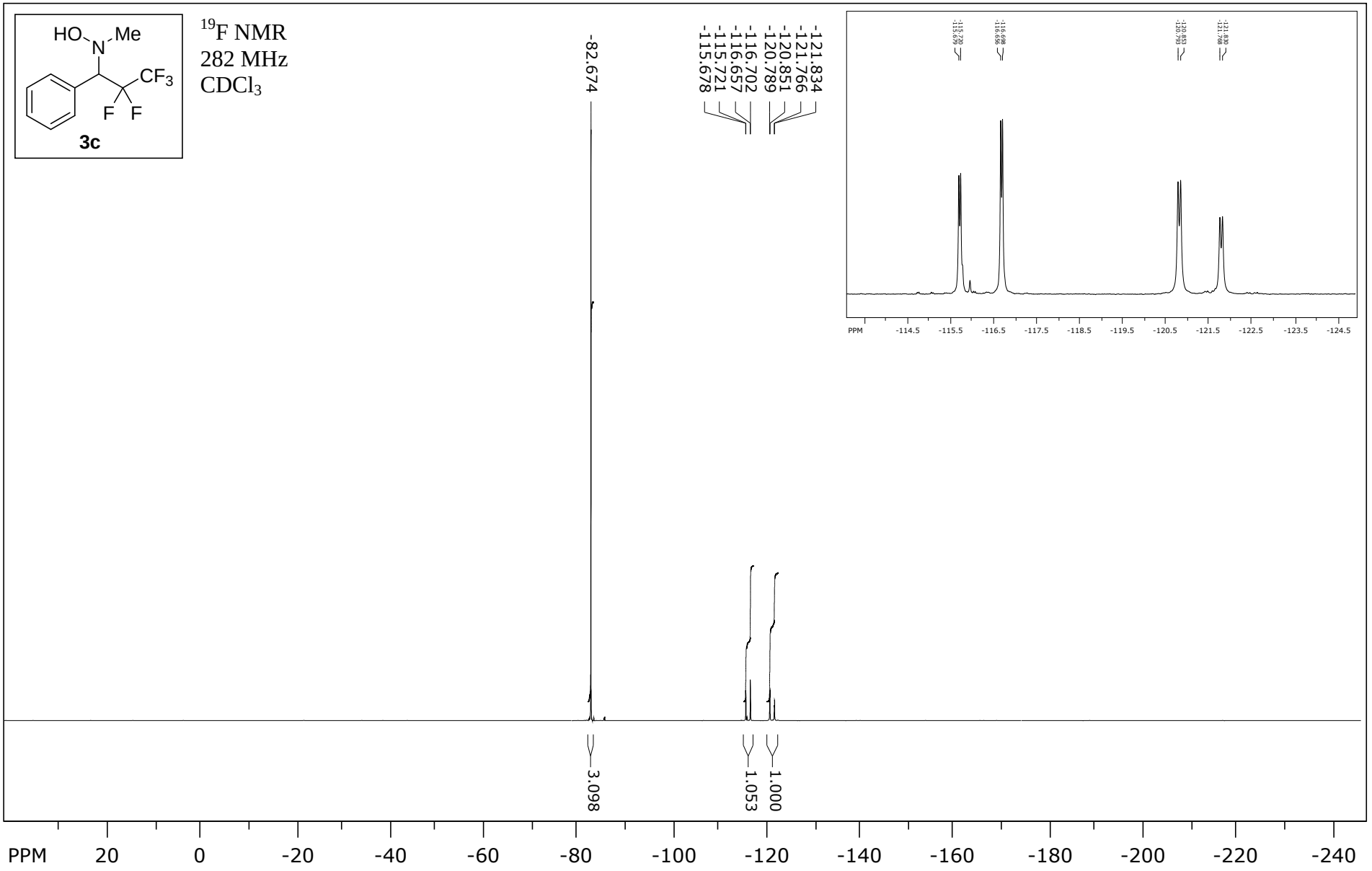
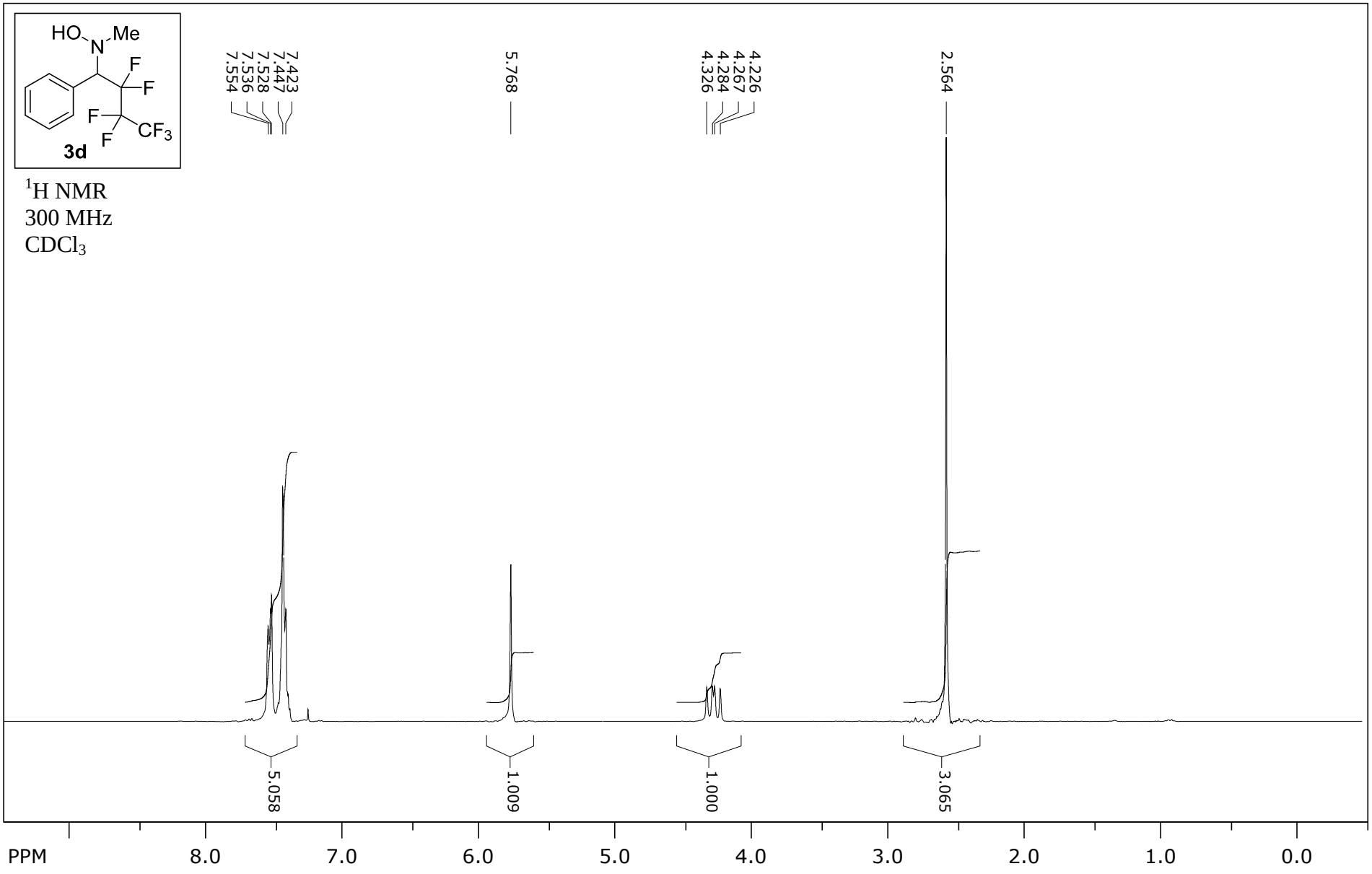
7.500
7.432
7.407
7.260
5.444
4.207
4.168
4.150
4.109
2.542
5.041
1.006
1.012
2.999
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

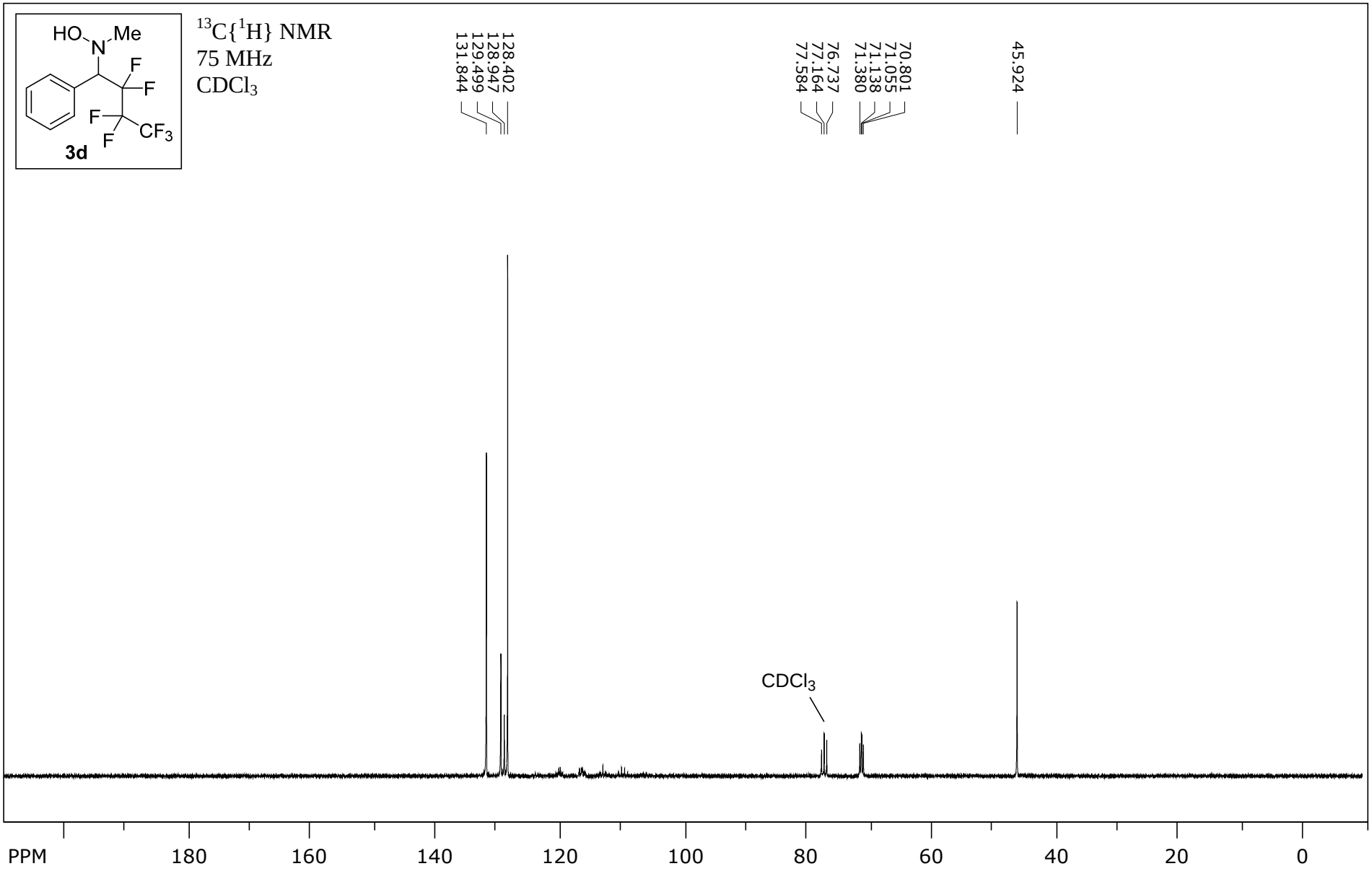


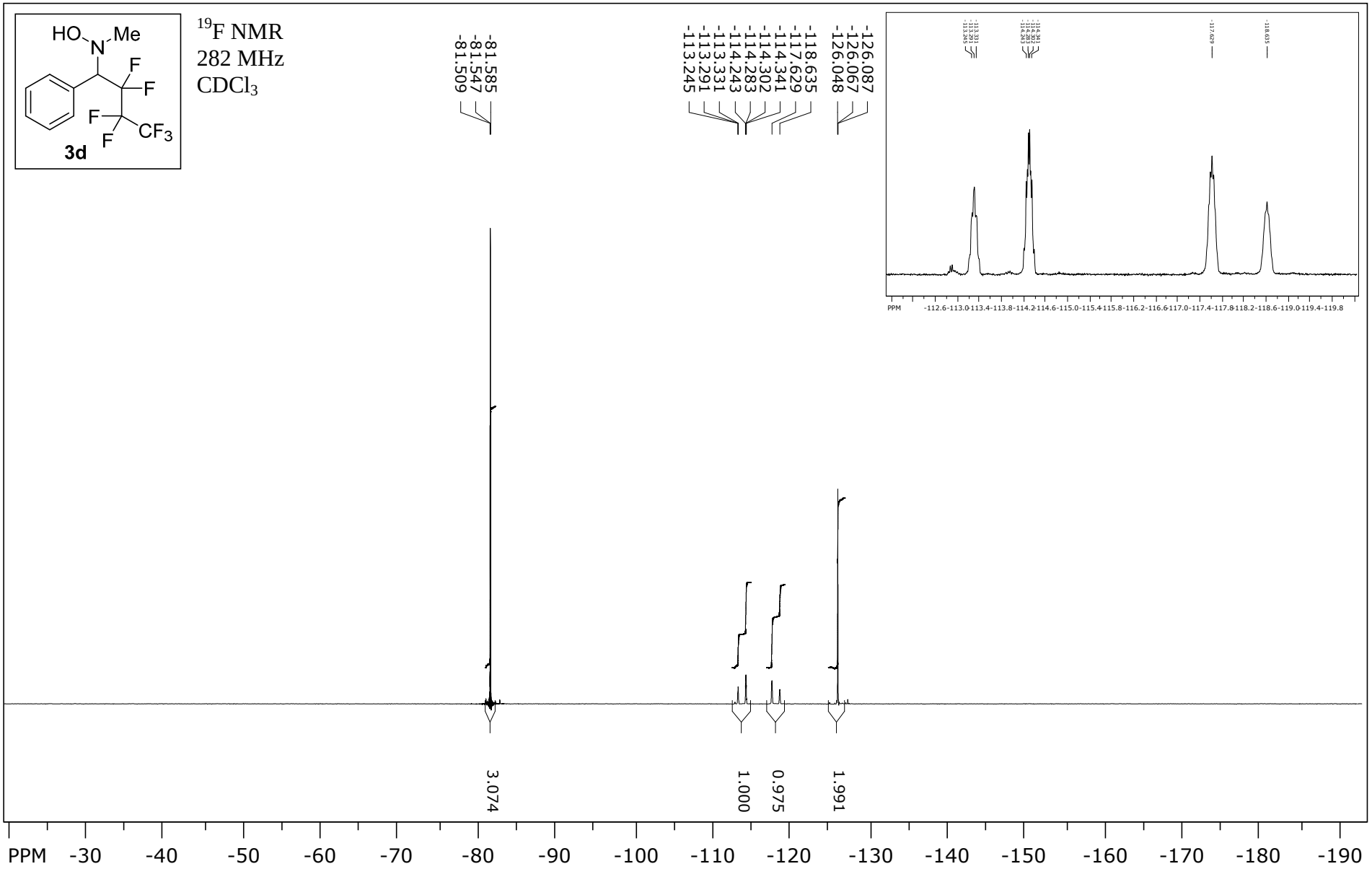
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$

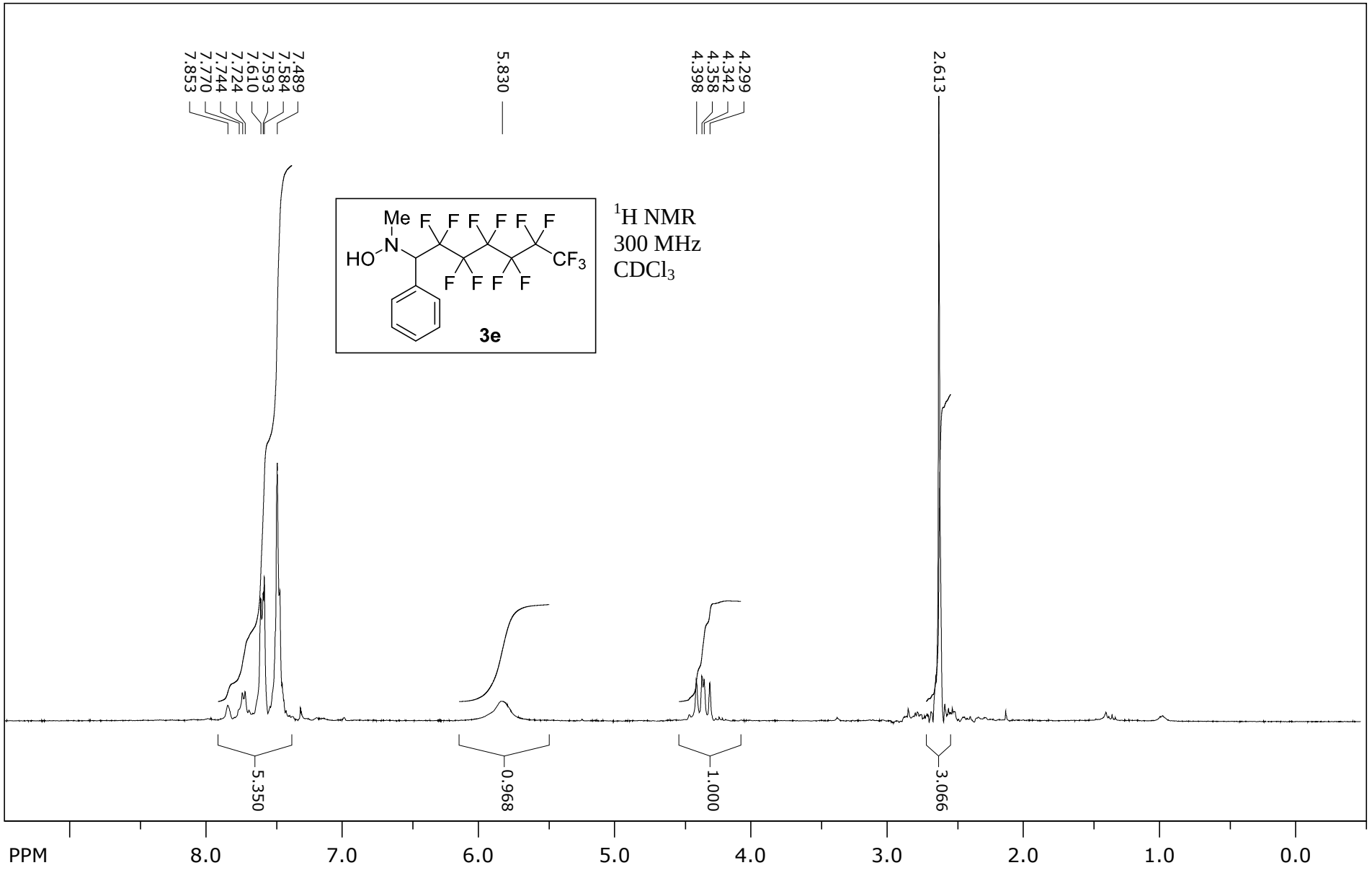

HO
N
Me
CF3
F F
3c
19F NMR
282 MHz
CDCl3
-82.674
-115.678
-115.721
-116.657
-116.702
-120.789
-120.851
-121.766
-121.834
3.098
1.053
1.000
PPM
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
-220
-240
PPM
-114.5
-115.5
-116.5
-117.5
-118.5
-119.5
-120.5
-121.5
-122.5
-123.5
-124.5

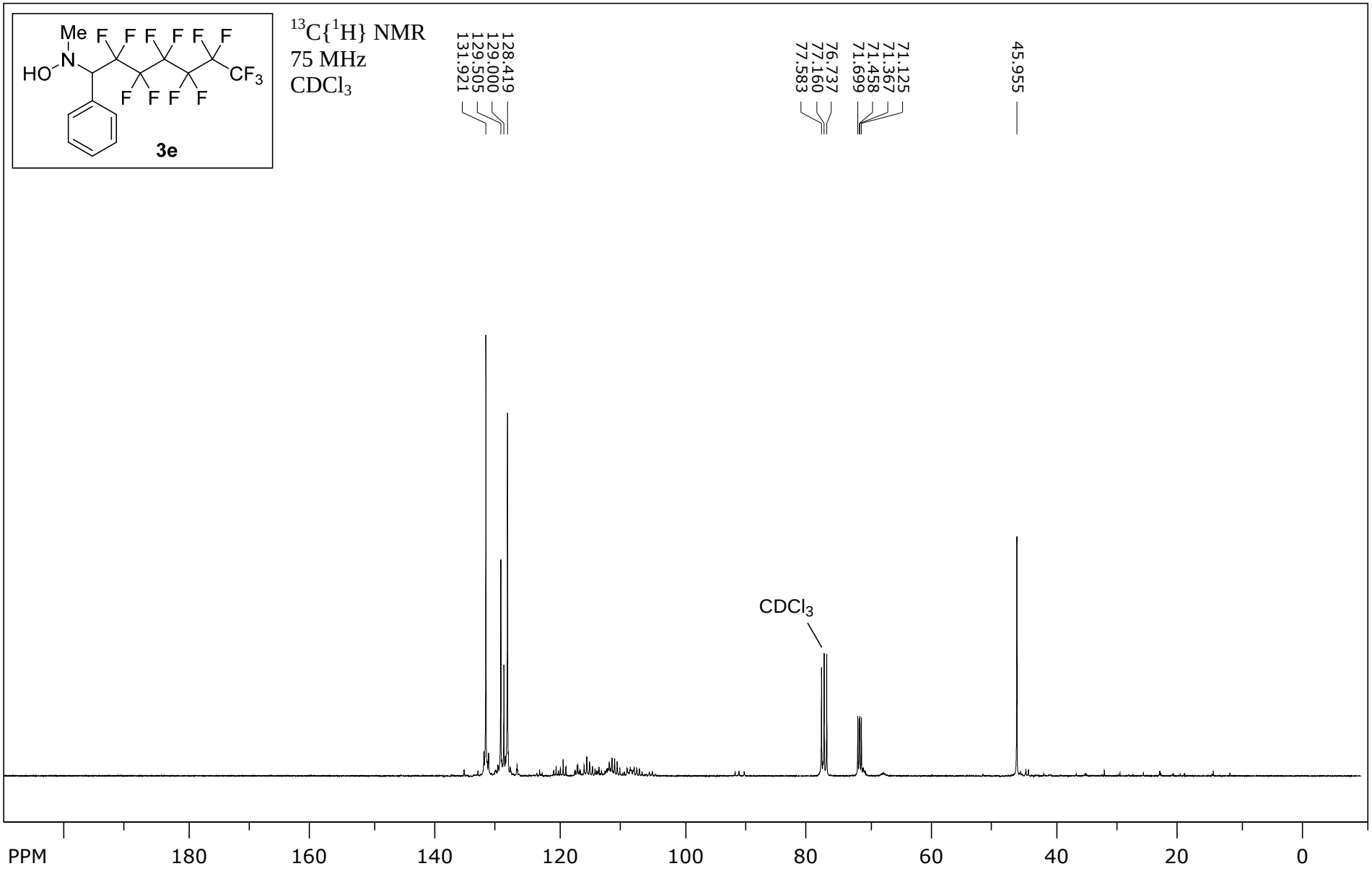


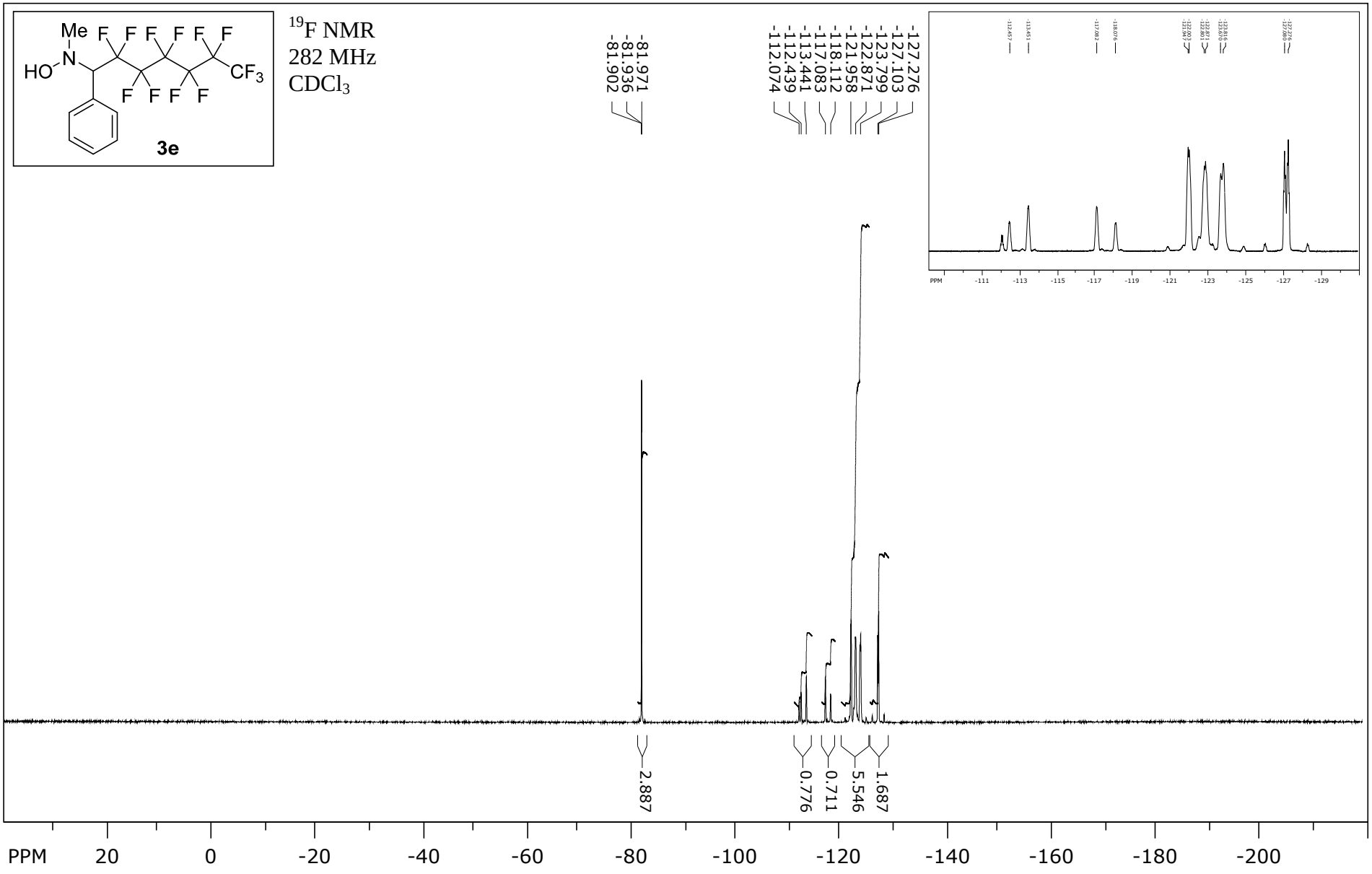
^{1}H NMR
300 MHz
$CDCl_3$

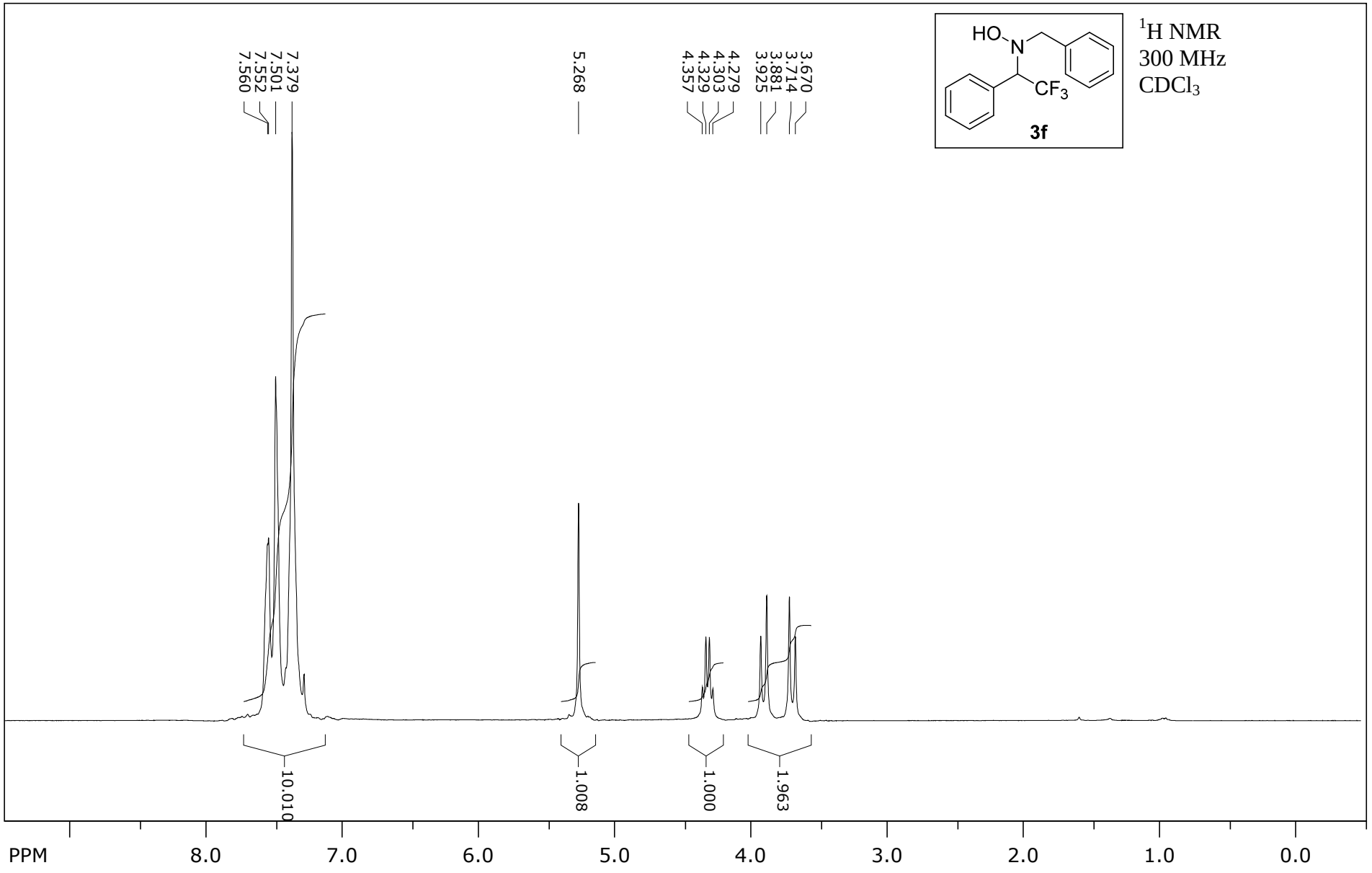

HO
N
Me
F
F
F
F
CF3
3d
13C{1H} NMR
75 MHz
CDCl3
131.844
129.499
128.947
128.402
77.584
77.164
76.737
71.380
71.138
71.055
70.801
45.924
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0

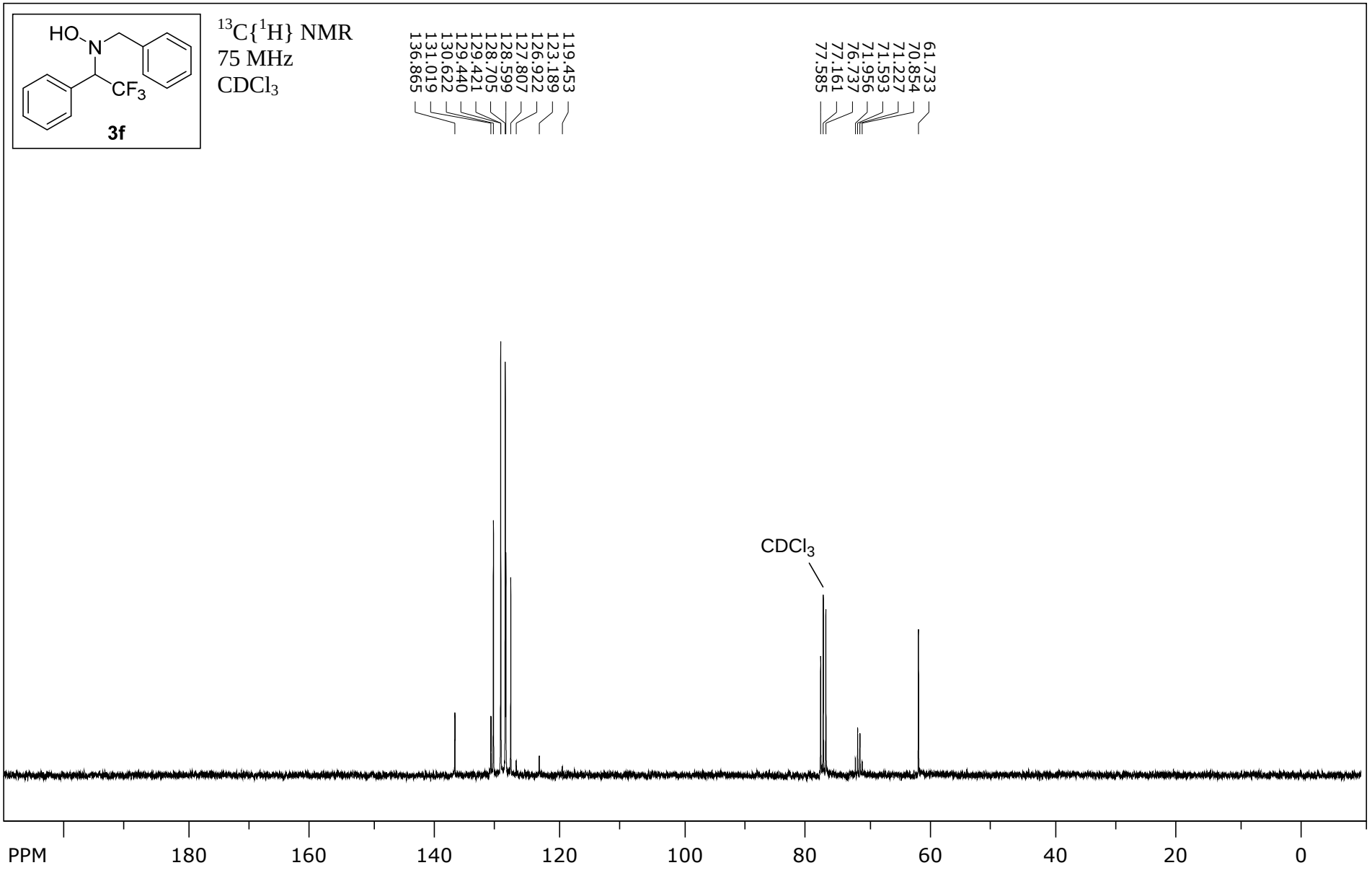

HO
N
Me
F
F
F
F
CF3
3d
19F NMR
282 MHz
CDCl3
-81.509
-81.547
-81.585
-113.245
-113.291
-113.331
-114.243
-114.283
-114.302
-114.341
-117.629
-118.635
-126.048
-126.067
-126.087
3.074
1.000
0.975
1.991
PPM -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190

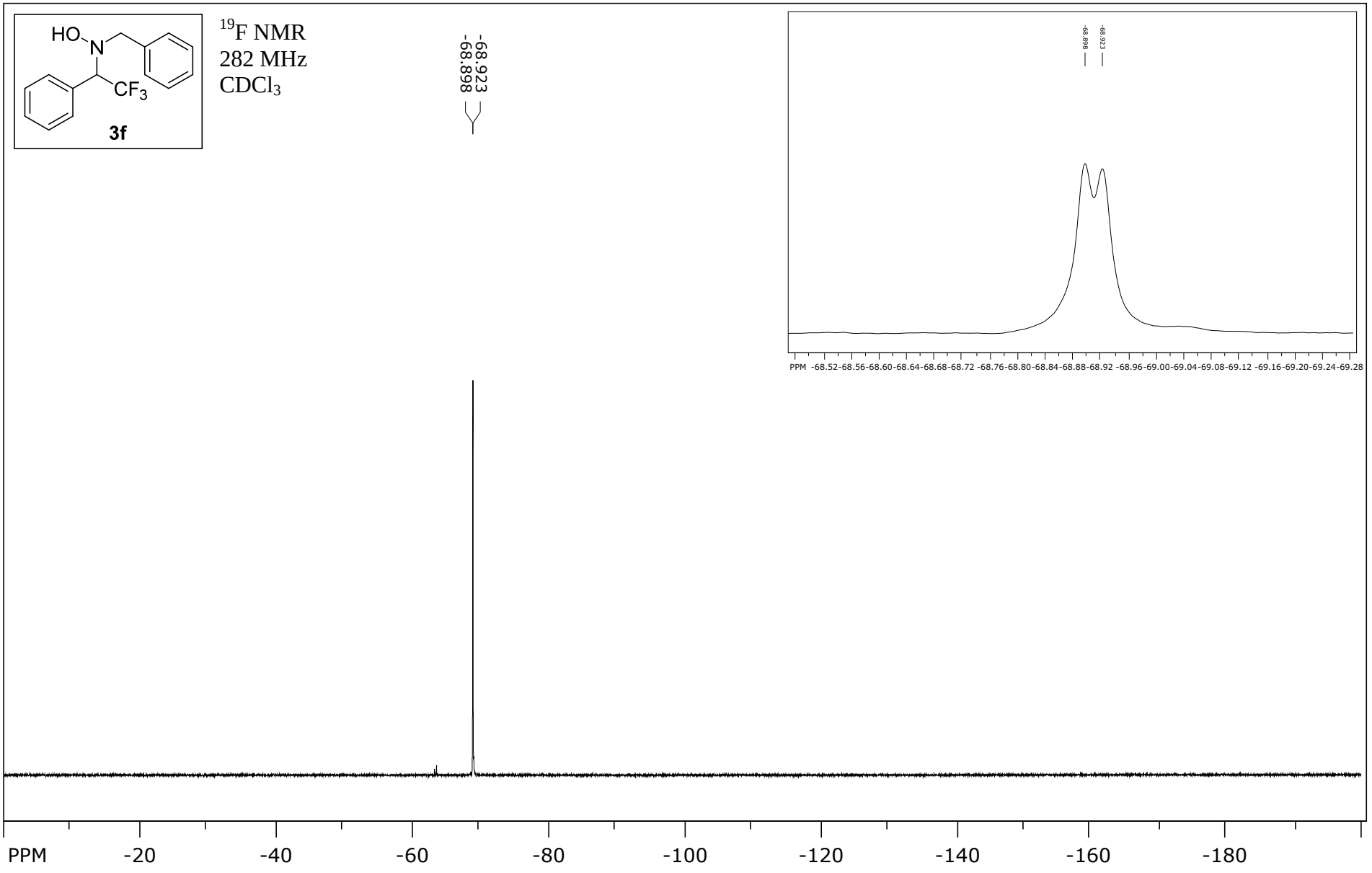

7.853
7.770
7.744
7.724
7.610
7.593
7.584
7.489
5.830
4.398
4.358
4.342
4.299
2.613
Me
N
HO
F
CF3
3e
1H NMR
300 MHz
CDCl3
5.350
0.968
1.000
3.066
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

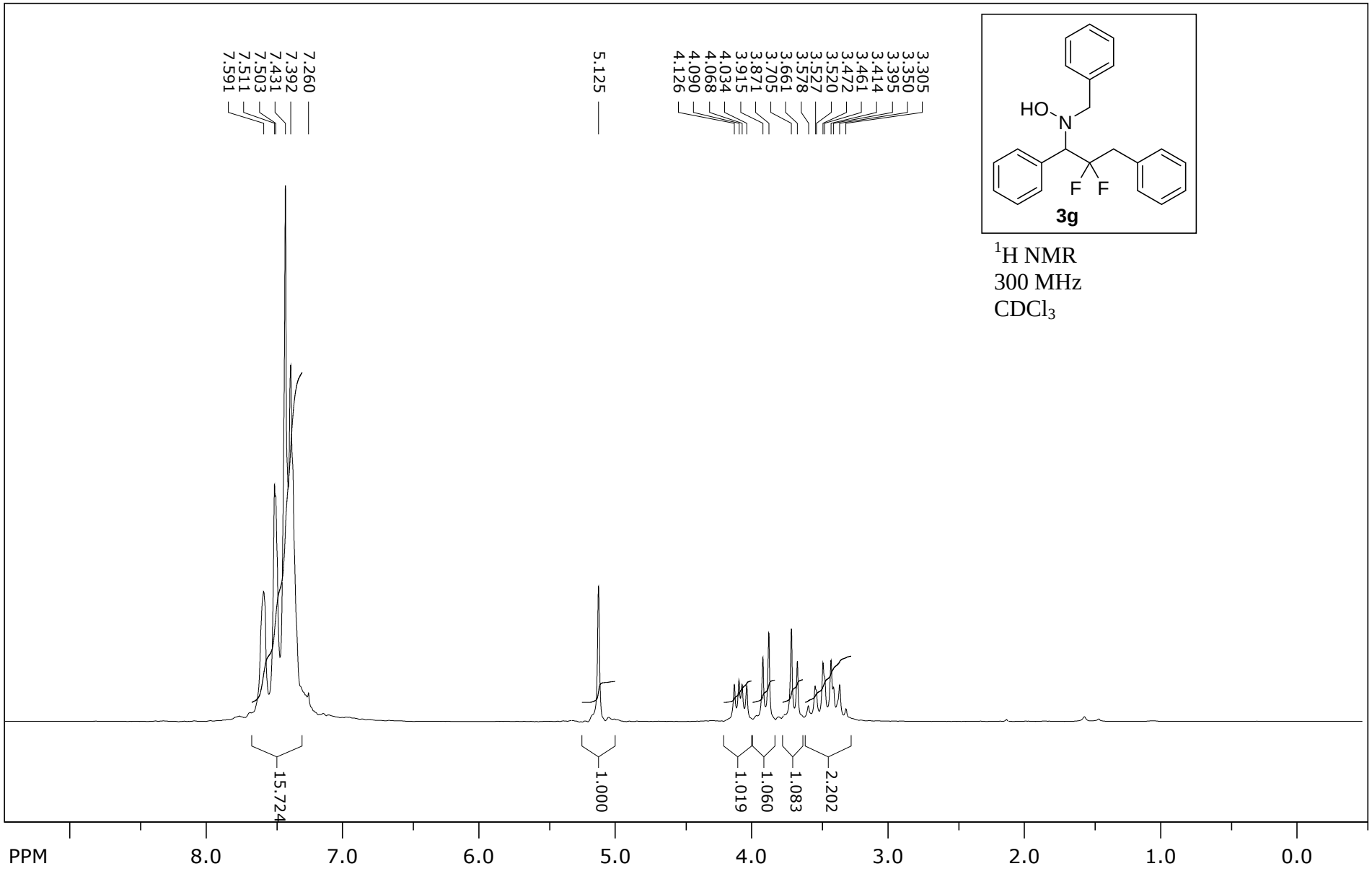

Me
F F F F F F
HO N
CF3
F F F F
3e
13C{1H} NMR
75 MHz
CDCl3
131.921
129.505
129.000
128.419
77.583
77.160
76.737
71.699
71.458
71.367
71.125
45.955
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0

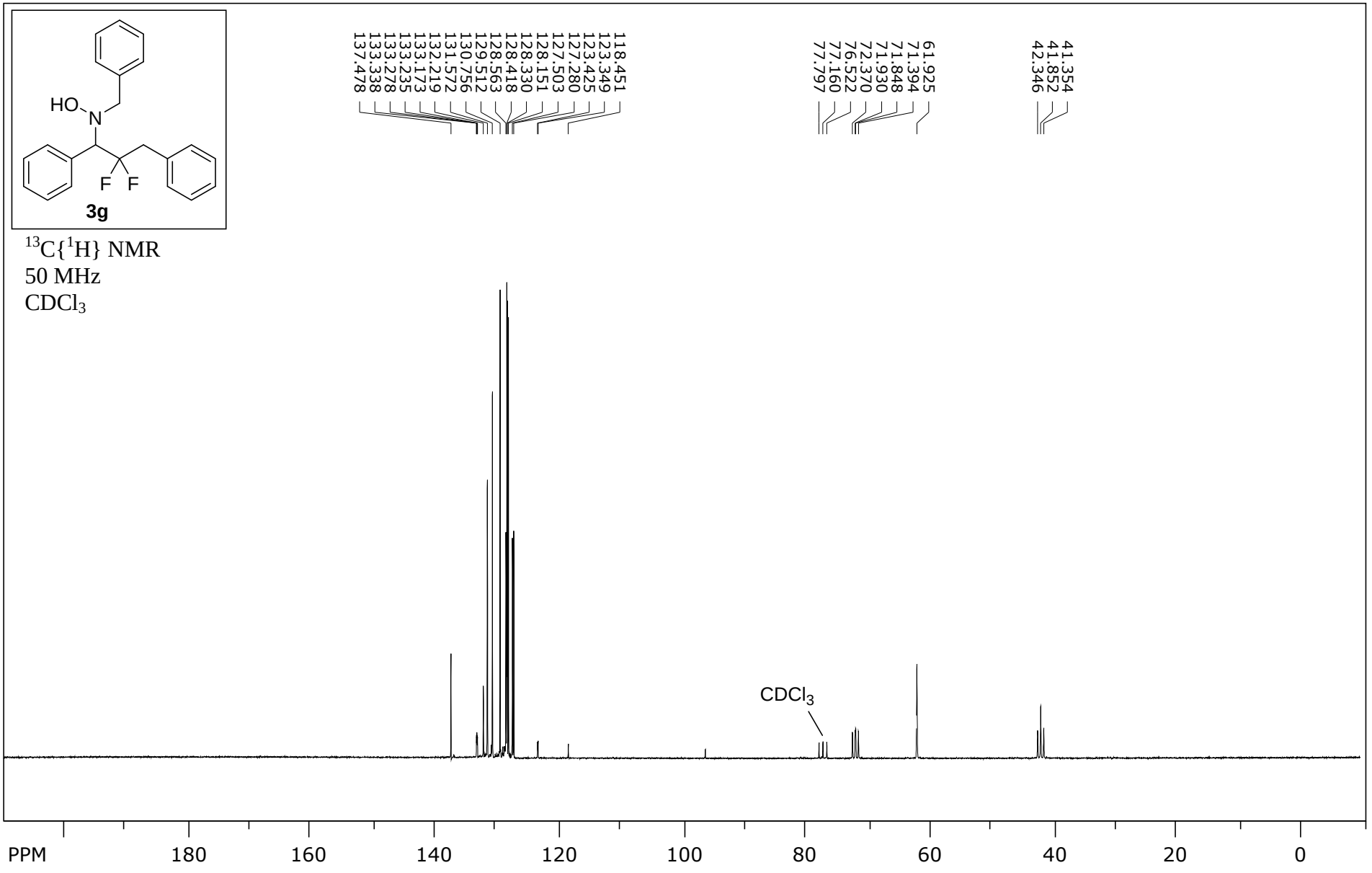

Me
F F F F F F
HO
N
CF3
F F F F
3e
19F NMR
282 MHz
CDCl3
-81.902
-81.936
-81.971
-112.074
-112.439
-113.441
-117.083
-118.112
-121.958
-122.871
-123.799
-127.103
-127.276
2.887
0.776
0.711
5.546
1.687
PPM
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200

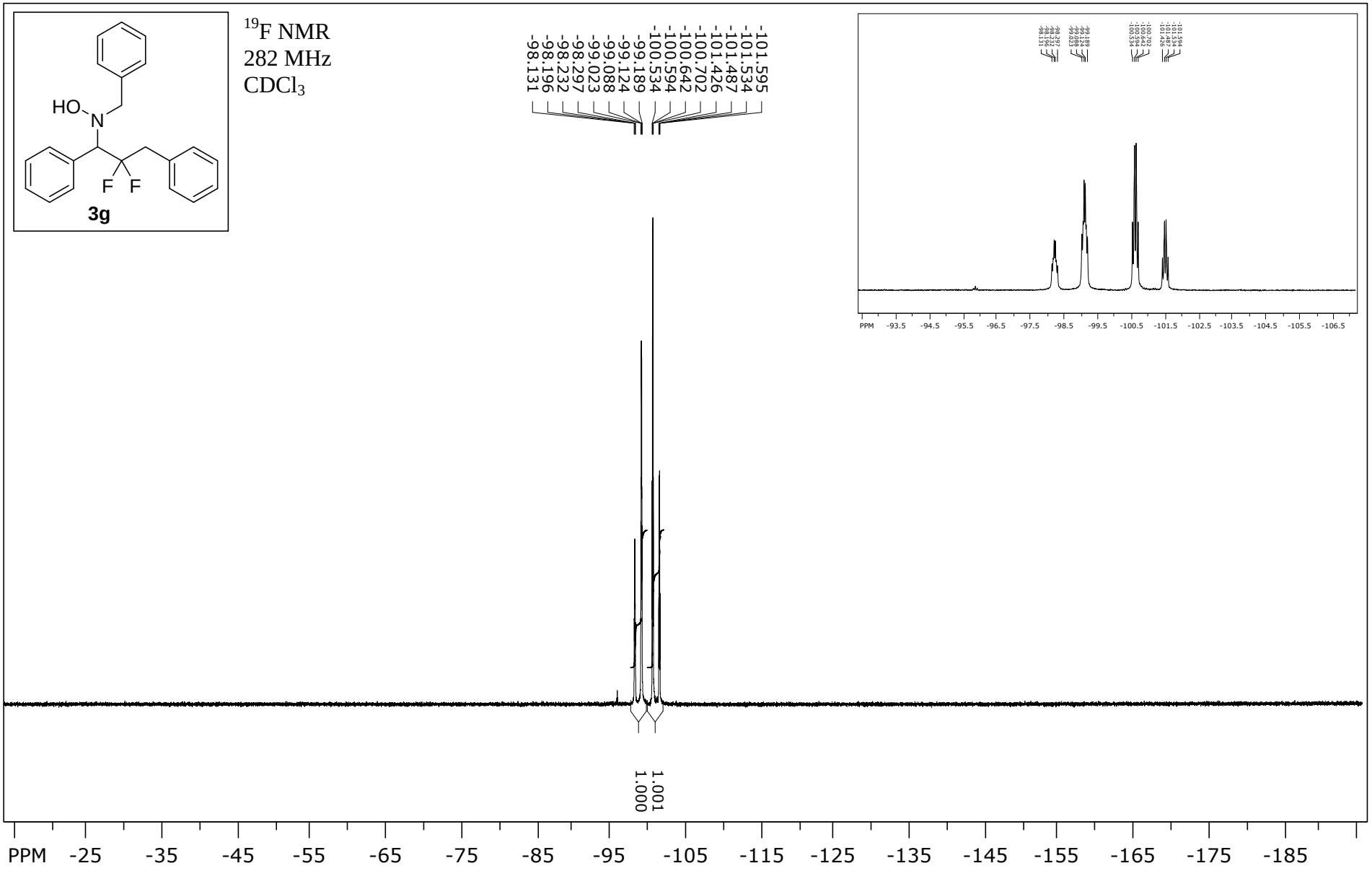

7.560
7.552
7.501
7.379
5.268
4.357
4.329
4.303
4.279
3.925
3.881
3.714
3.670
HO
N
CF3
3f
1H NMR
300 MHz
CDCl3
10.010
1.008
1.000
1.963
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

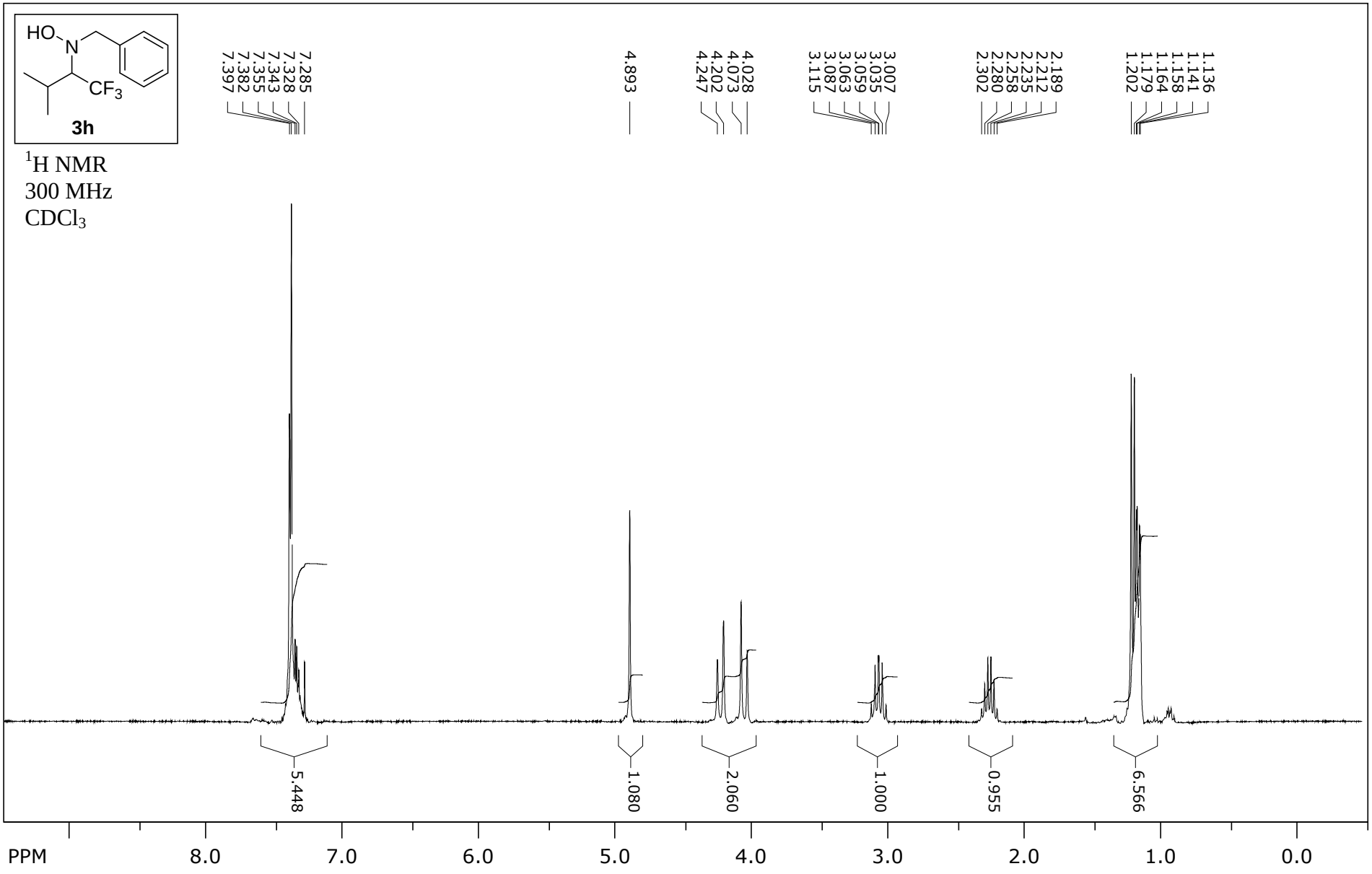

HO
N
CF3
3f
13C{1H} NMR
75 MHz
CDCl3
136.865
131.019
130.622
129.440
129.421
128.705
128.599
127.807
126.922
123.189
119.453
77.585
77.161
76.737
71.956
71.593
71.227
70.854
61.733
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0

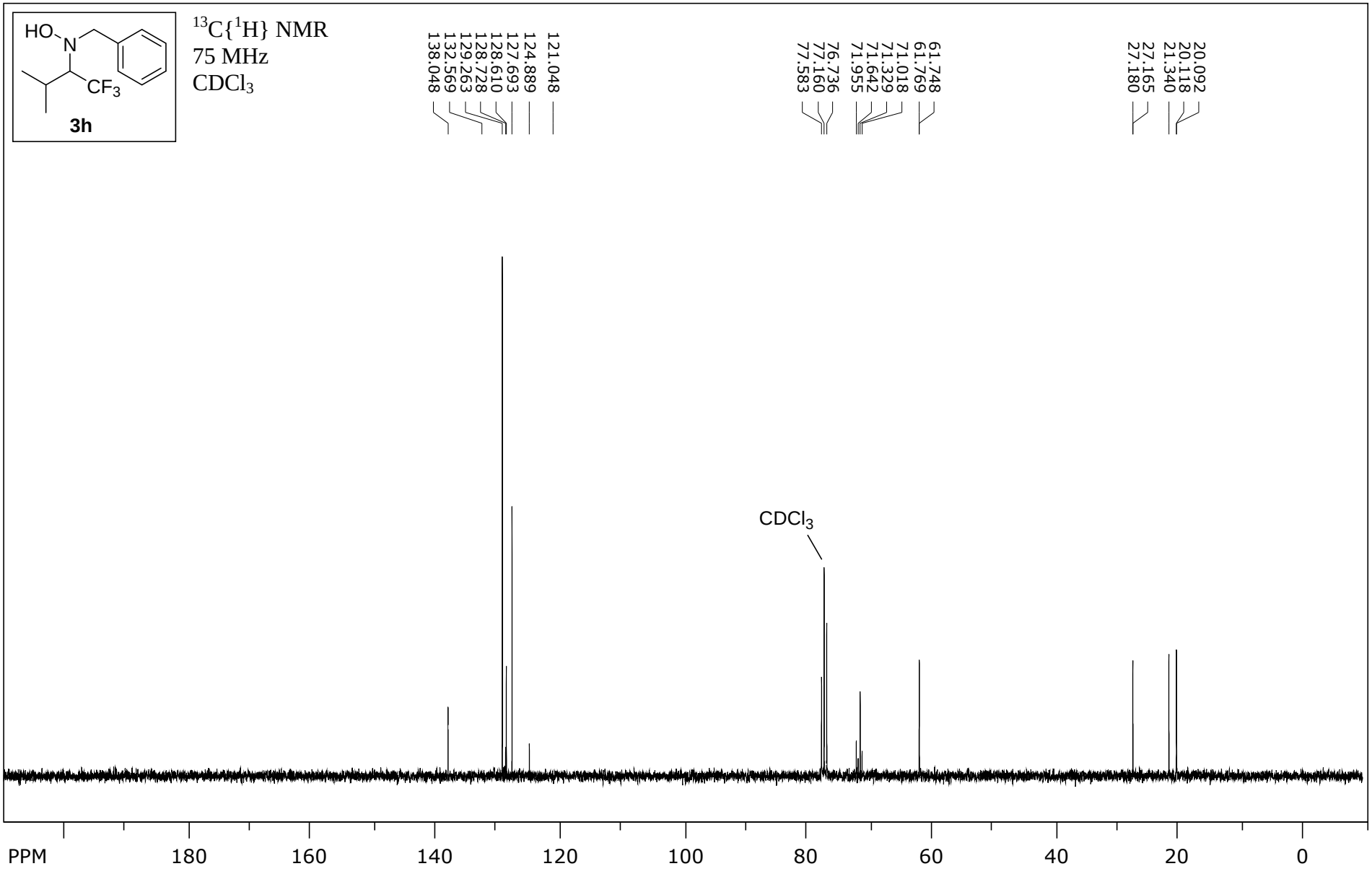

HO
N
CF3
3f
19F NMR
282 MHz
CDCl3
-68.923
-68.898
-68.898
-68.923
PPM -68.52-68.56-68.60-68.64-68.68-68.72 -68.76-68.80-68.84-68.88-68.92 -68.96-69.00-69.04-69.08-69.12 -69.16-69.20-69.24-69.28
PPM -20 -40 -60 -80 -100 -120 -140 -160 -180

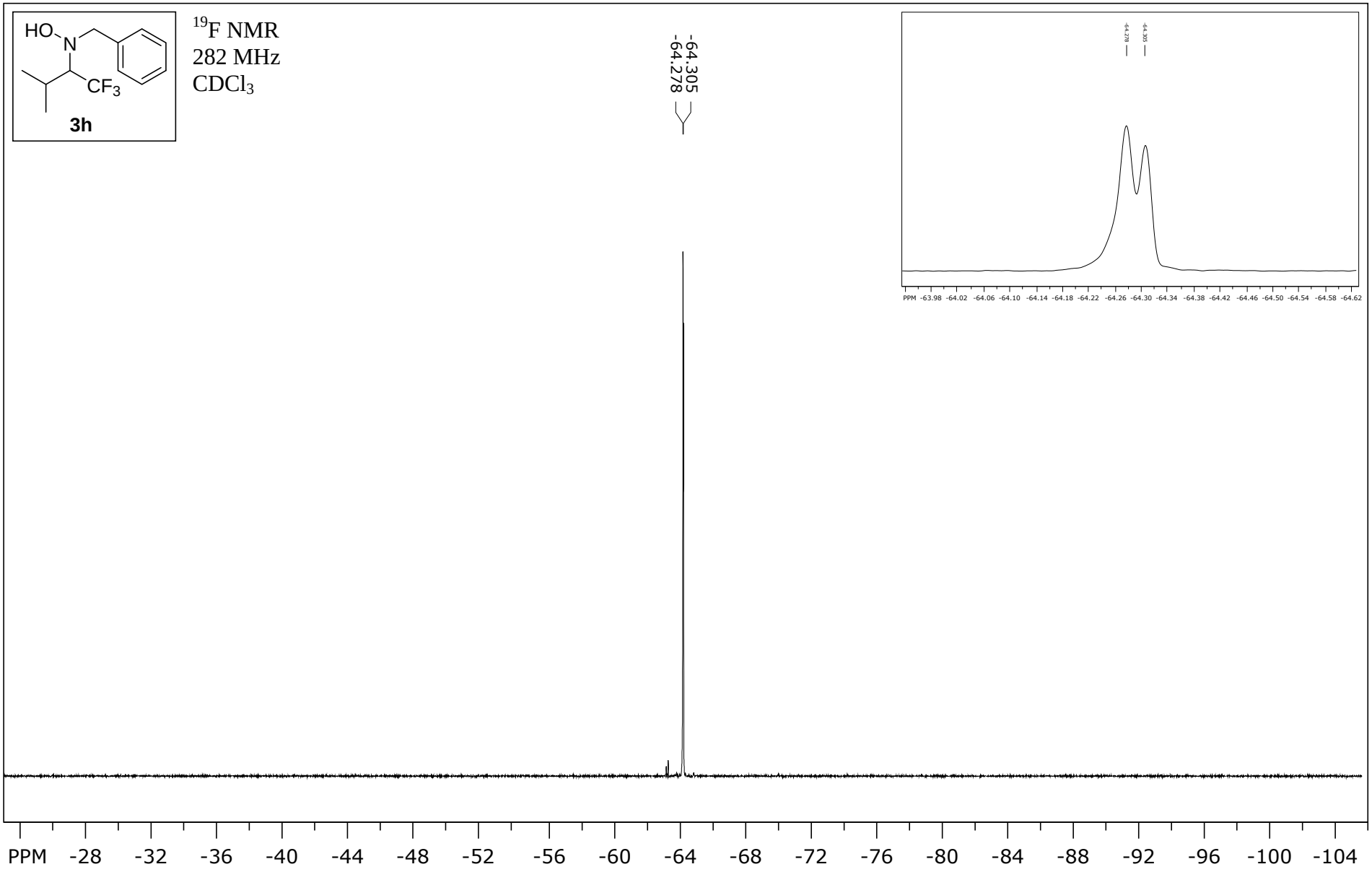

7.591
7.511
7.503
7.431
7.392
7.260
5.125
4.126
4.090
4.068
4.034
3.915
3.871
3.705
3.661
3.578
3.527
3.520
3.472
3.461
3.414
3.395
3.350
3.305
HO
N
F
F
3g
1H NMR
300 MHz
CDCl3
15.724
1.000
1.019
1.060
1.083
2.202
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

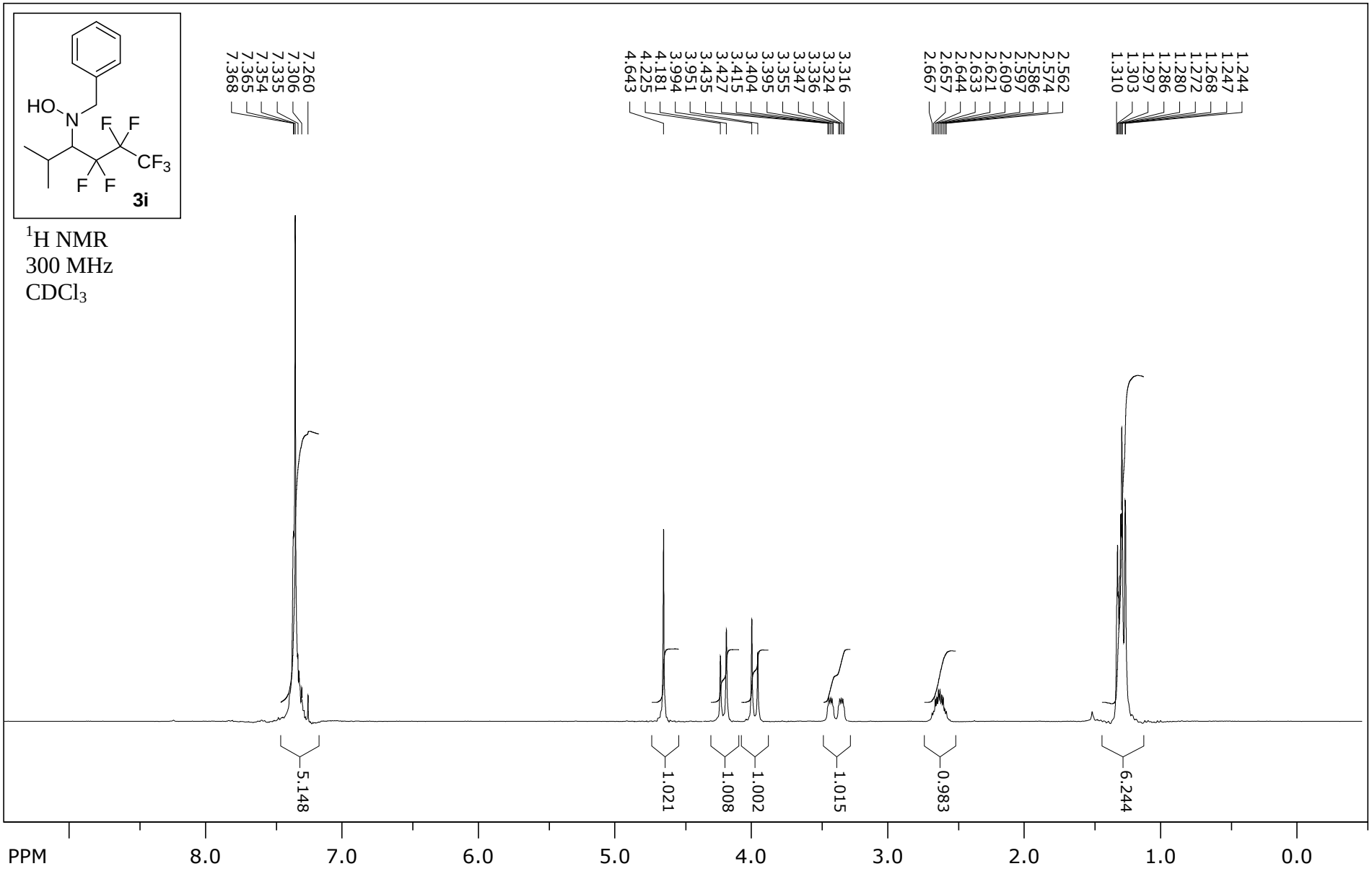

HO
N
F F
3g
137.478
133.338
133.278
133.235
133.173
132.219
131.572
130.756
129.512
128.563
128.418
128.330
128.151
127.503
127.280
123.425
123.349
118.451
77.797
77.160
76.522
72.370
71.930
71.848
71.394
61.925
42.346
41.852
41.354
$^{13}C\{^{1}H\}$ NMR
50 MHz
$CDCl_3$
$CDCl_3$
PPM
180
160
140
120
100
80
60
40
20
0

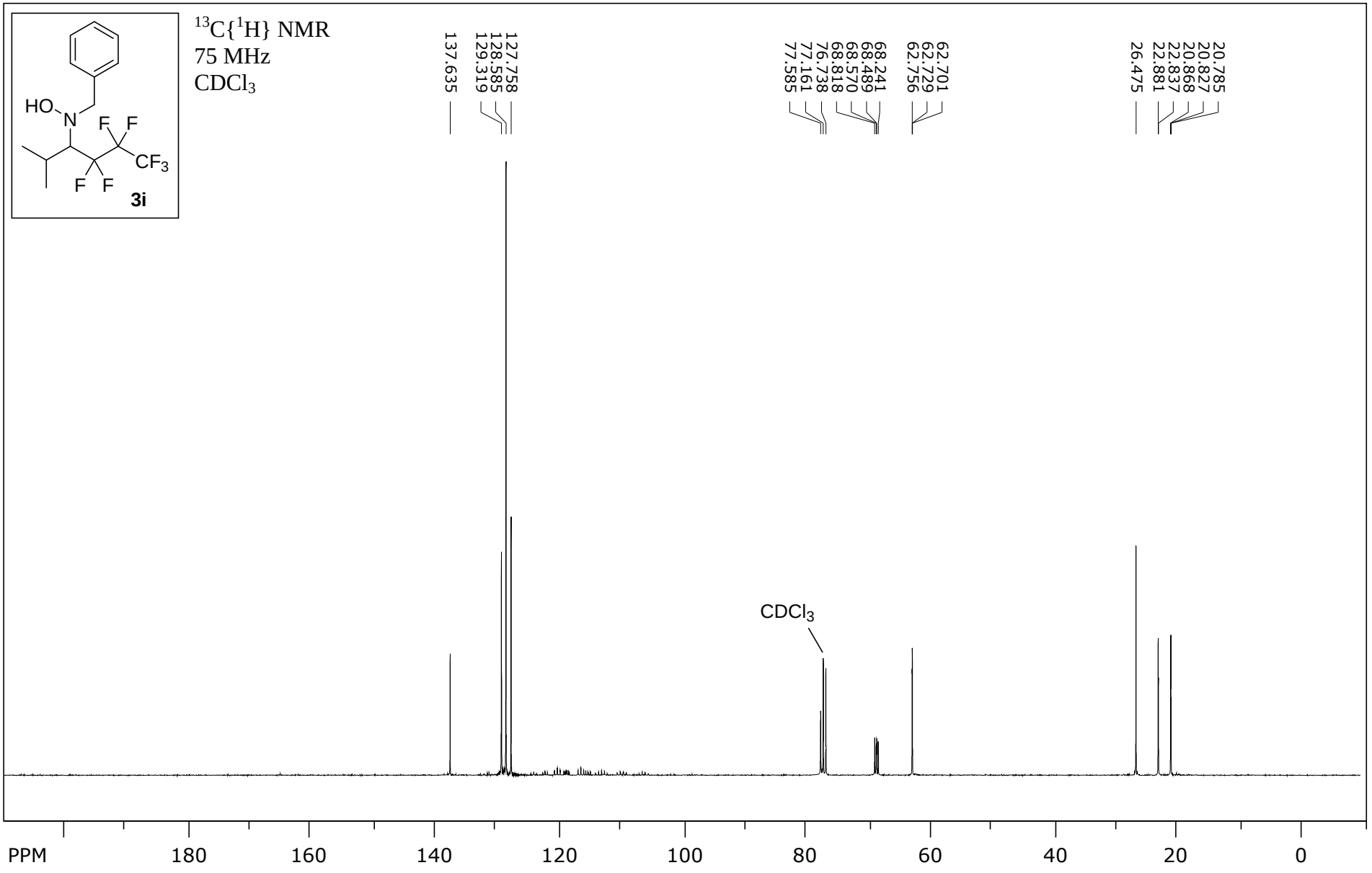

HO
N
F F
3g
19F NMR
282 MHz
CDCl3
-98.131
-98.196
-98.232
-98.297
-99.023
-99.088
-99.124
-99.189
-100.534
-100.594
-100.642
-100.702
-101.426
-101.487
-101.534
-101.595
1.000
1.001
PPM -25 -35 -45 -55 -65 -75 -85 -95 -105 -115 -125 -135 -145 -155 -165 -175 -185
PPM -93.5 -94.5 -95.5 -96.5 -97.5 -98.5 -99.5 -100.5 -101.5 -102.5 -103.5 -104.5 -105.5 -106.5

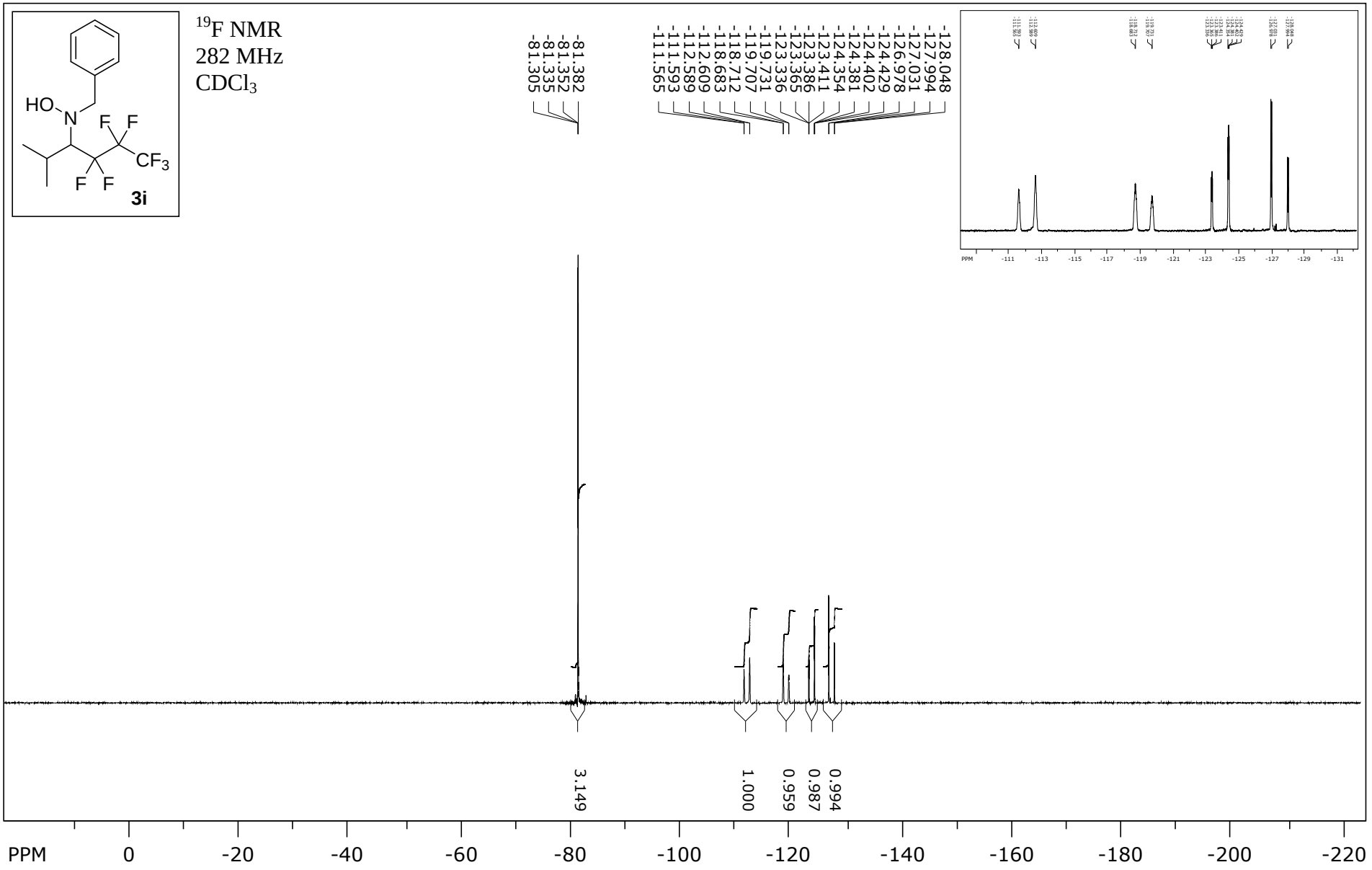

HO
N
CF3
3h
1H NMR
300 MHz
CDCl3
7.397
7.382
7.355
7.343
7.328
7.285
4.893
4.247
4.202
4.073
4.028
3.115
3.087
3.063
3.059
3.035
3.007
2.302
2.280
2.258
2.235
2.212
2.189
1.202
1.179
1.164
1.158
1.141
1.136
5.448
1.080
2.060
1.000
0.955
6.566
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

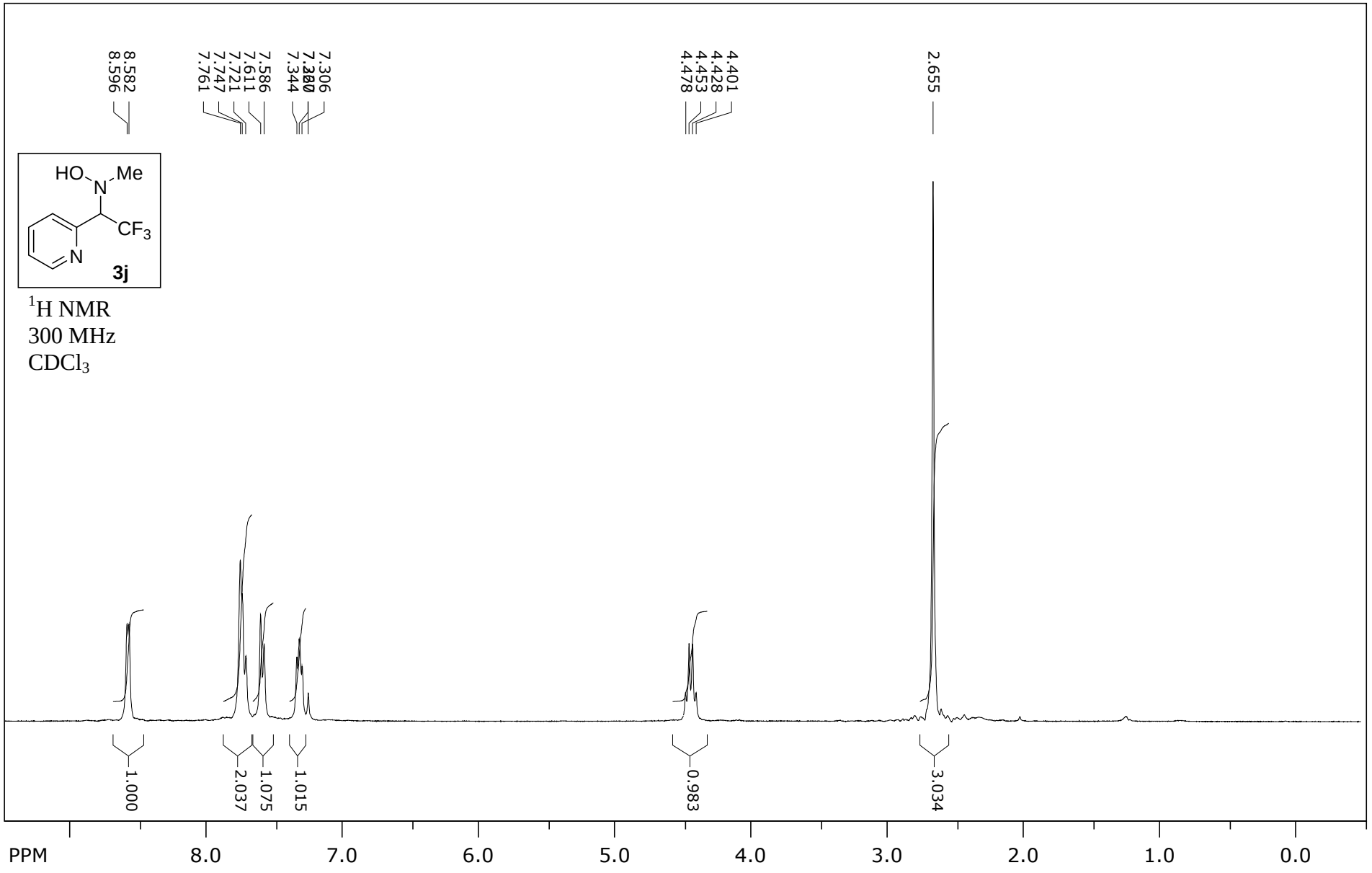

HO
N
CF3
3h
13C{1H} NMR
75 MHz
CDCl3
138.048
132.569
129.263
128.728
128.610
127.693
124.889
121.048
77.583
77.160
76.736
71.955
71.642
71.329
71.018
61.769
61.748
27.180
27.165
21.340
20.118
20.092
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0

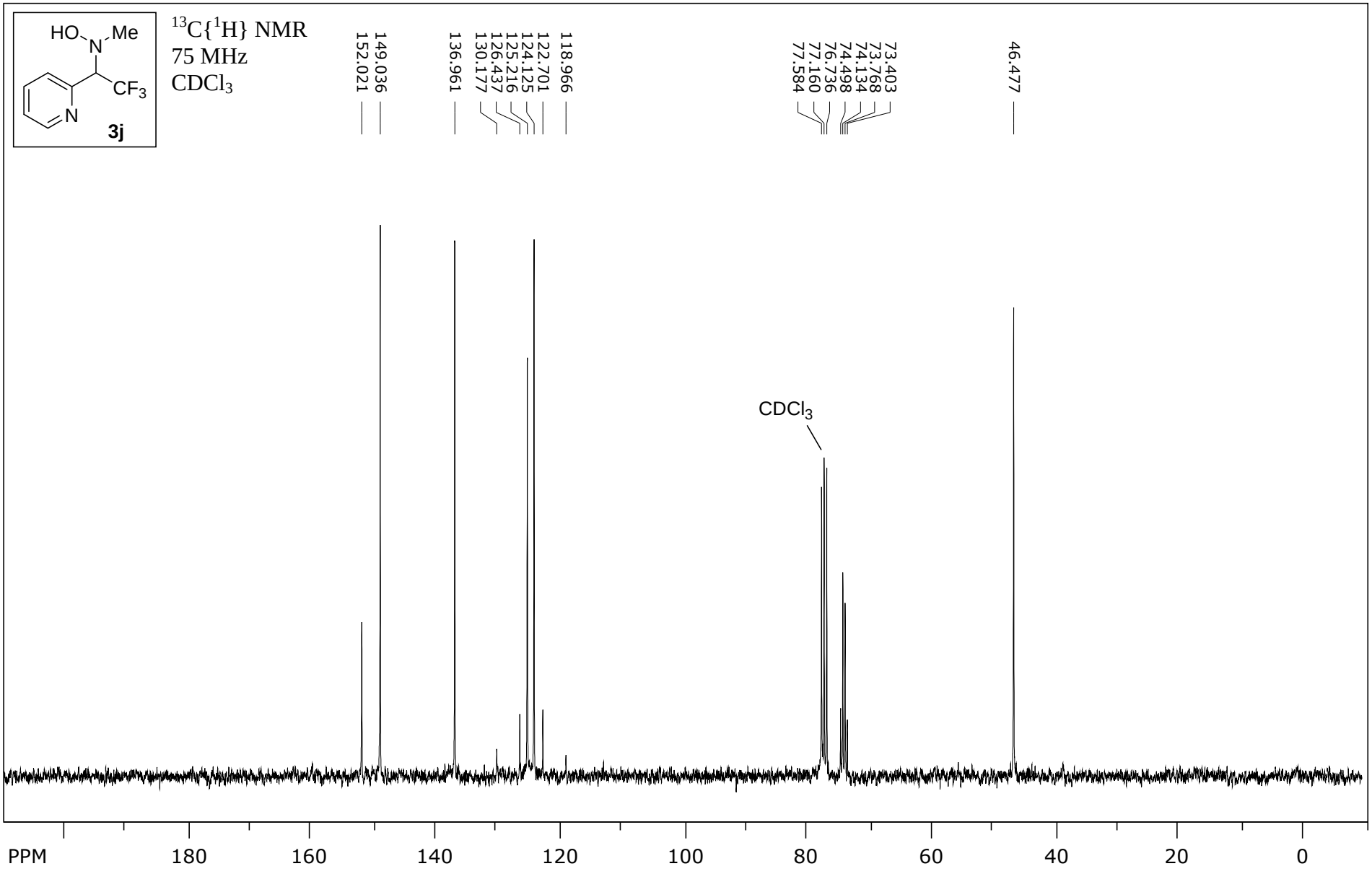

HO
N
CF3
3h
19F NMR
282 MHz
CDCl3
-64.305
-64.278
PPM -63.98 -64.02 -64.06 -64.10 -64.14 -64.18 -64.22 -64.26 -64.30 -64.34 -64.38 -64.42 -64.46 -64.50 -64.54 -64.58 -64.62
PPM -28 -32 -36 -40 -44 -48 -52 -56 -60 -64 -68 -72 -76 -80 -84 -88 -92 -96 -100 -104

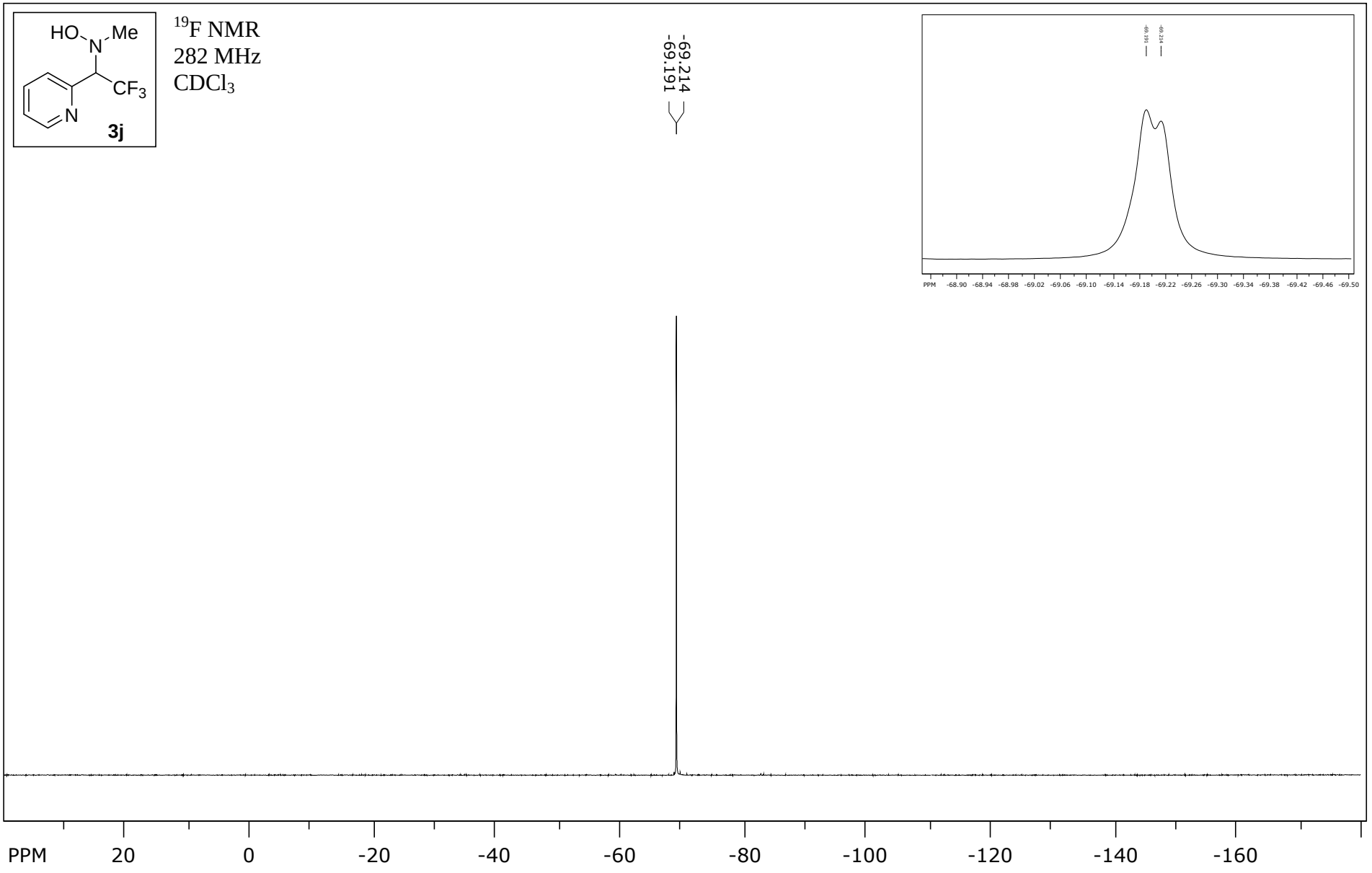

HO
N
F F
CF3
F F
3i
1H NMR
300 MHz
CDCl3
7.368
7.365
7.354
7.335
7.306
7.260
4.643
4.225
4.181
3.994
3.951
3.435
3.427
3.415
3.404
3.395
3.355
3.347
3.336
3.324
3.316
2.667
2.657
2.644
2.633
2.621
2.609
2.597
2.586
2.574
2.562
1.310
1.303
1.297
1.286
1.280
1.272
1.268
1.247
1.244
5.148
1.021
1.008
1.002
1.015
0.983
6.244
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

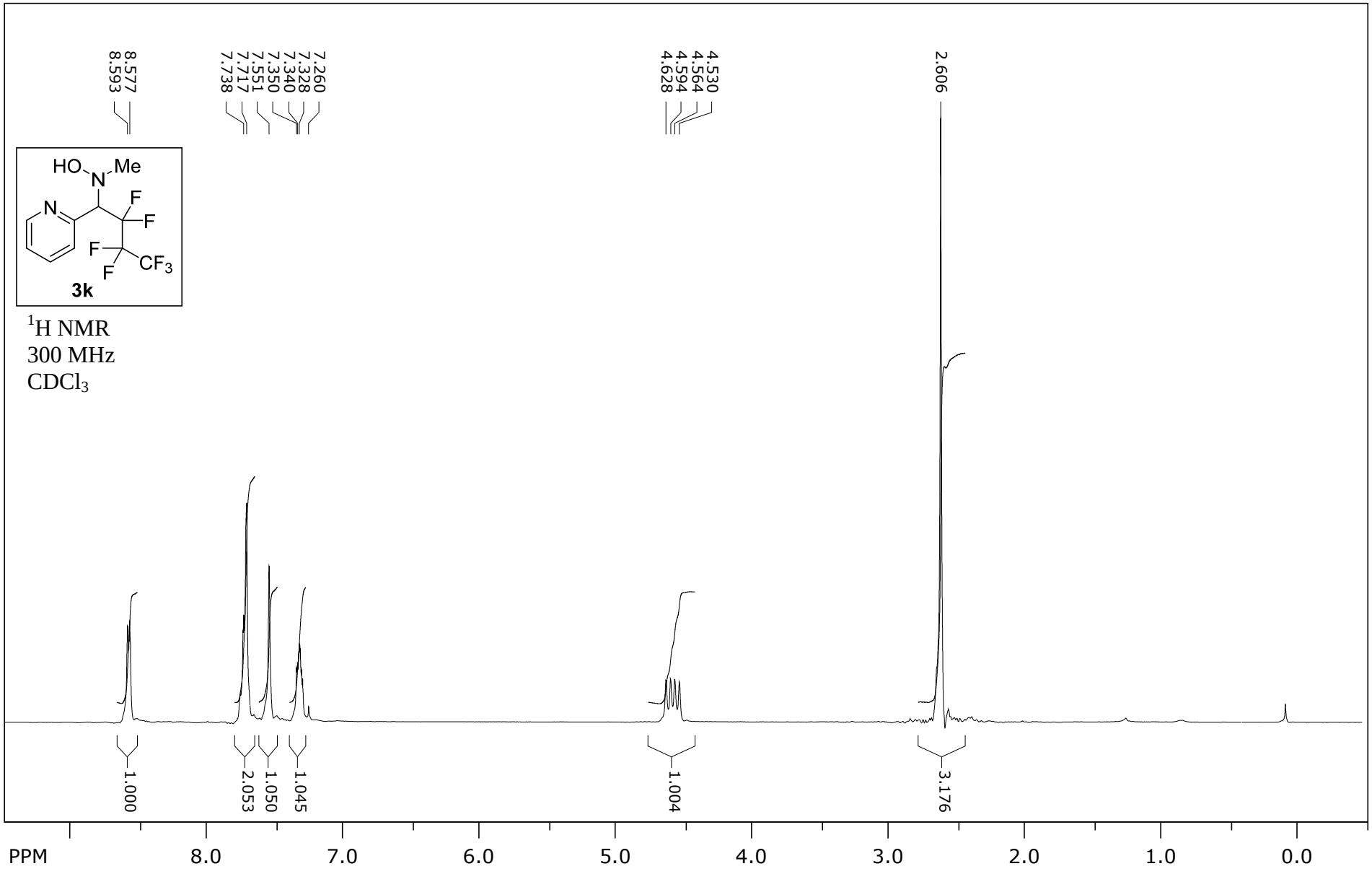

$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$
HO
N
F F
CF_3
F F
3i
137.635
129.319
128.585
127.758
77.585
77.161
76.738
68.818
68.570
68.489
68.241
62.756
62.729
62.701
26.475
22.881
22.837
20.868
20.827
20.785
$CDCl_3$
PPM
180
160
140
120
100
80
60
40
20
0

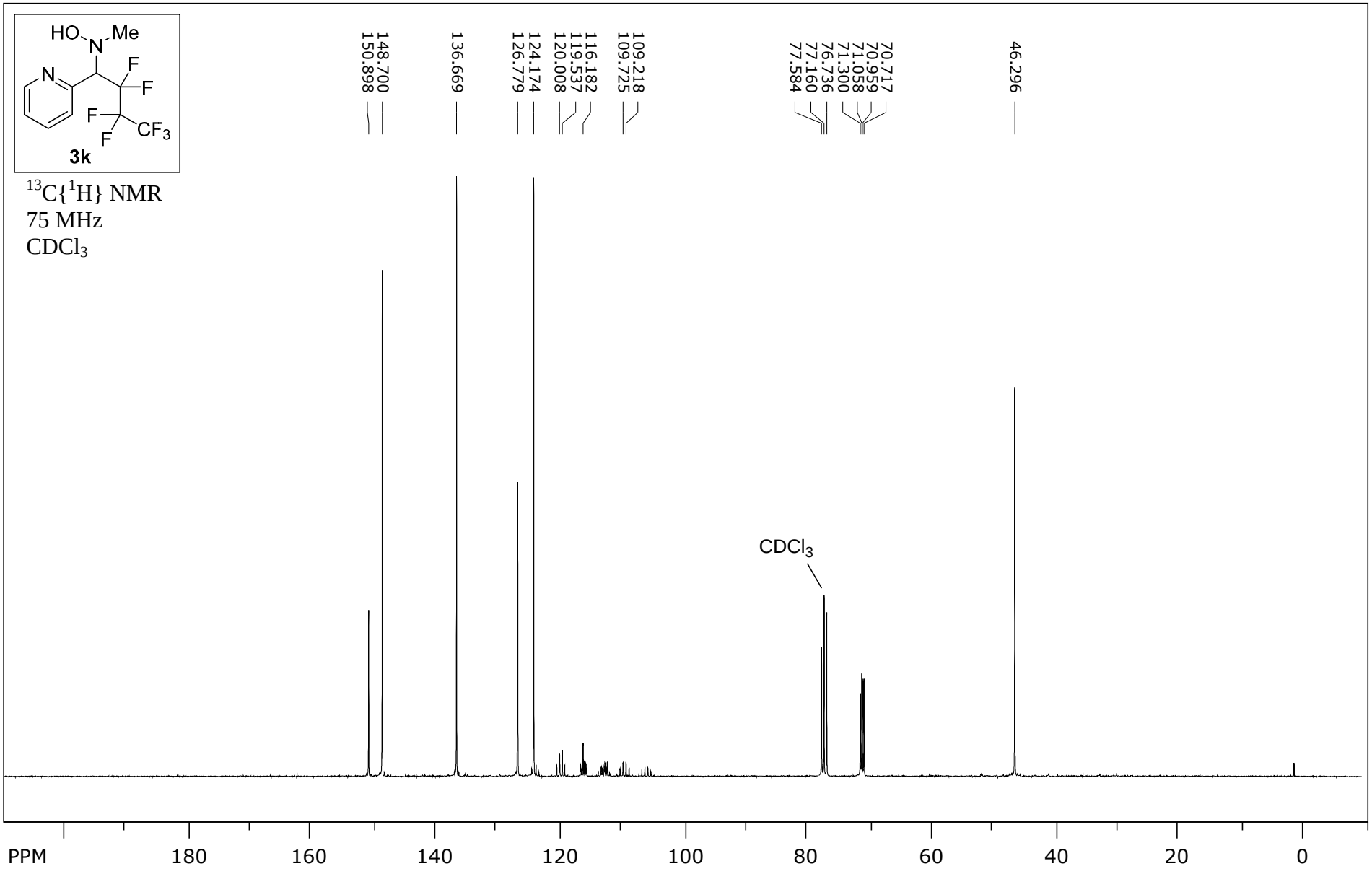

HO
N
F F
CF3
F F
3i
19F NMR
282 MHz
CDCl3
-81.305
-81.335
-81.352
-81.382
-111.565
-111.593
-112.589
-112.609
-118.683
-118.712
-119.707
-119.731
-123.336
-123.365
-123.386
-123.411
-124.354
-124.381
-124.402
-124.429
-126.978
-127.031
-127.994
-128.048
3.149
1.000
0.959
0.987
0.994
PPM
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
-220


8.582
8.596
7.761
7.747
7.721
7.611
7.586
7.344
4.478
4.453
4.428
4.401
2.655
HO
N
Me
CF3
N
3j
1H NMR
300 MHz
CDCl3
1.000
2.037
1.075
1.015
0.983
3.034
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

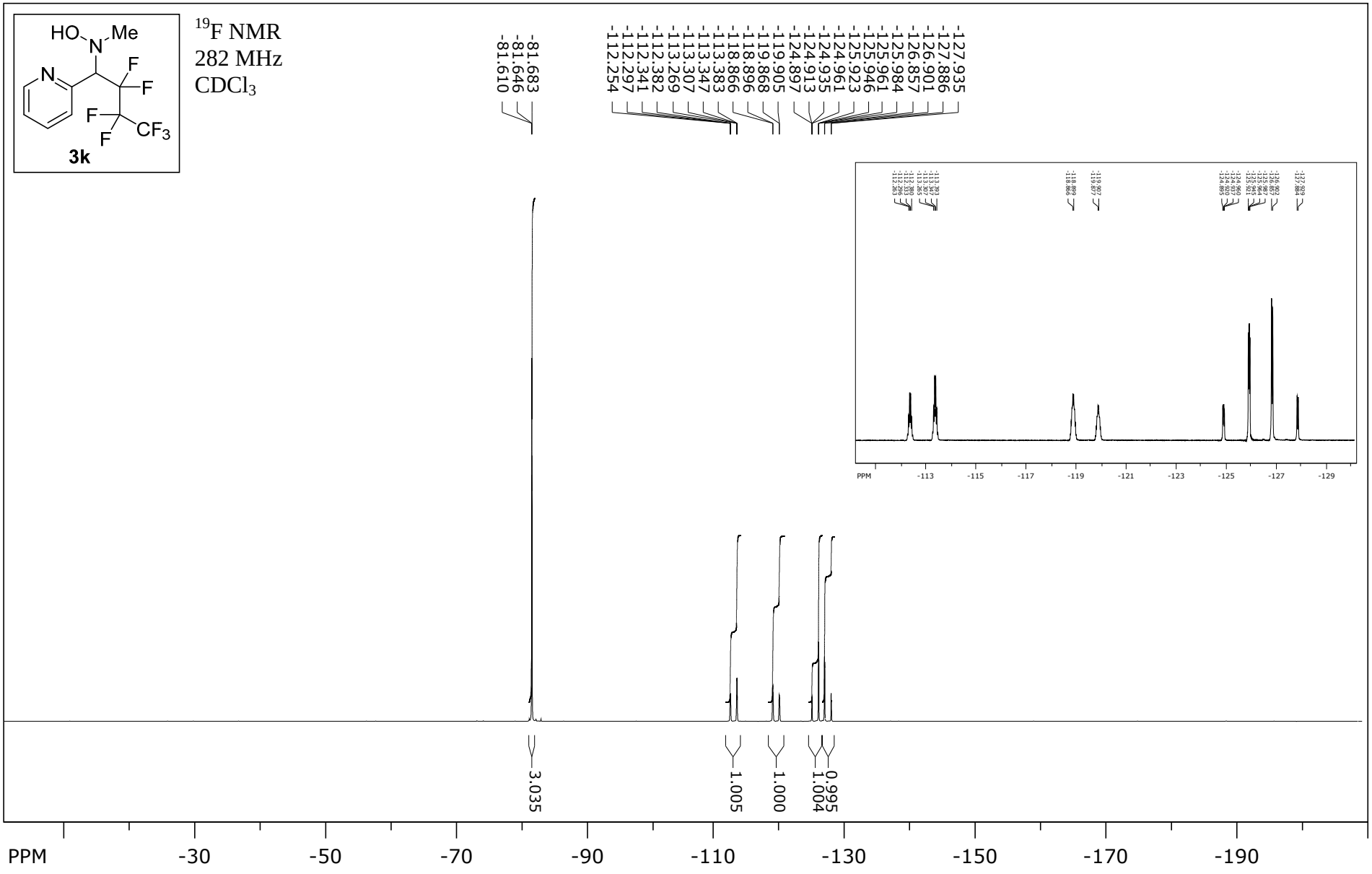

HO
N
Me
CF3
N
3j
13C{1H} NMR
75 MHz
CDCl3
152.021
149.036
136.961
130.177
126.437
125.216
124.125
122.701
118.966
77.584
77.160
76.736
74.498
74.134
73.768
73.403
46.477
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0

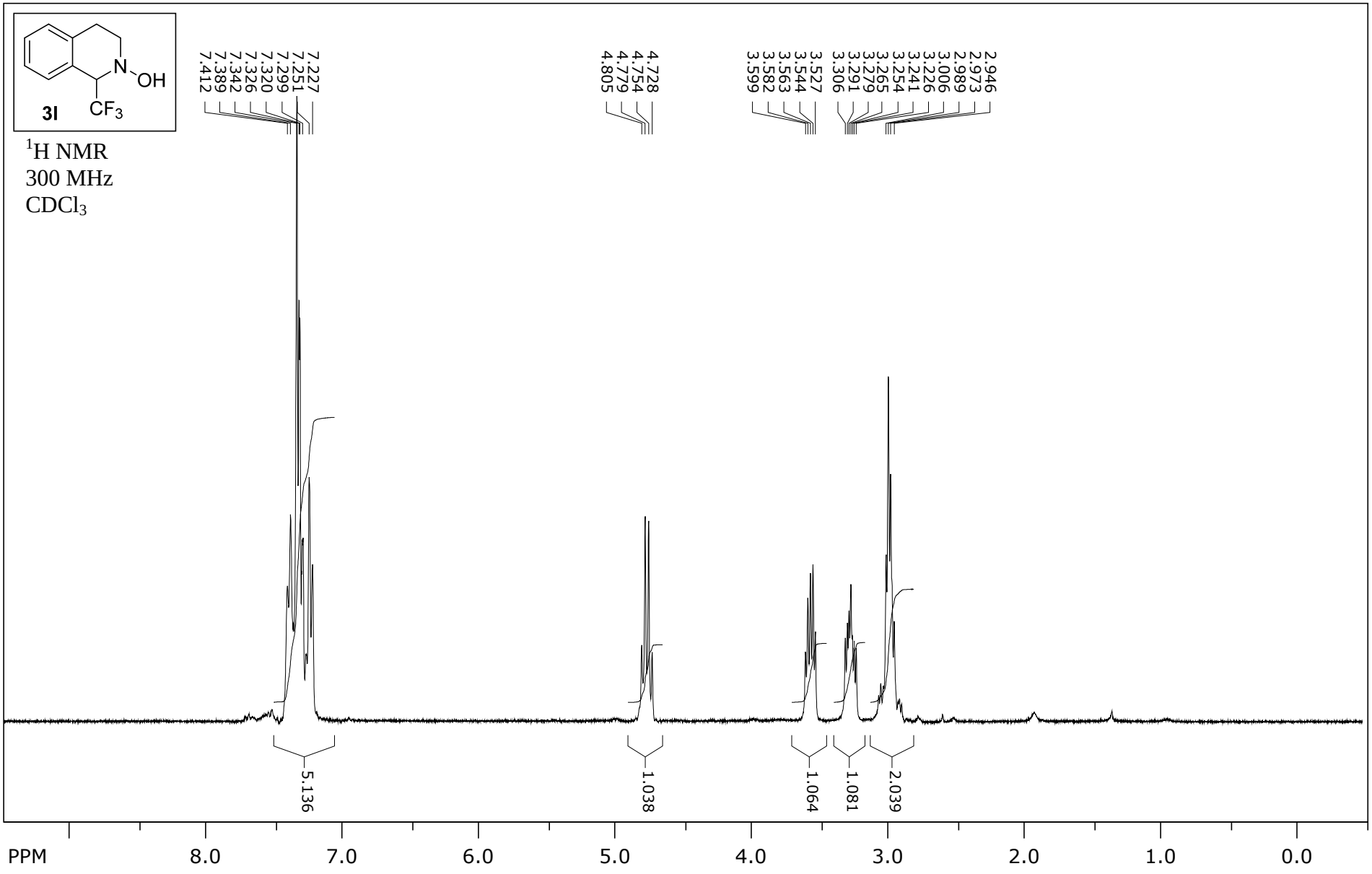

HO
N
Me
CF3
N
3j
19F NMR
282 MHz
CDCl3
-69.214
-69.191
PPM
20
0
-20
-40
-60
-80
-100
-120
-140
-160

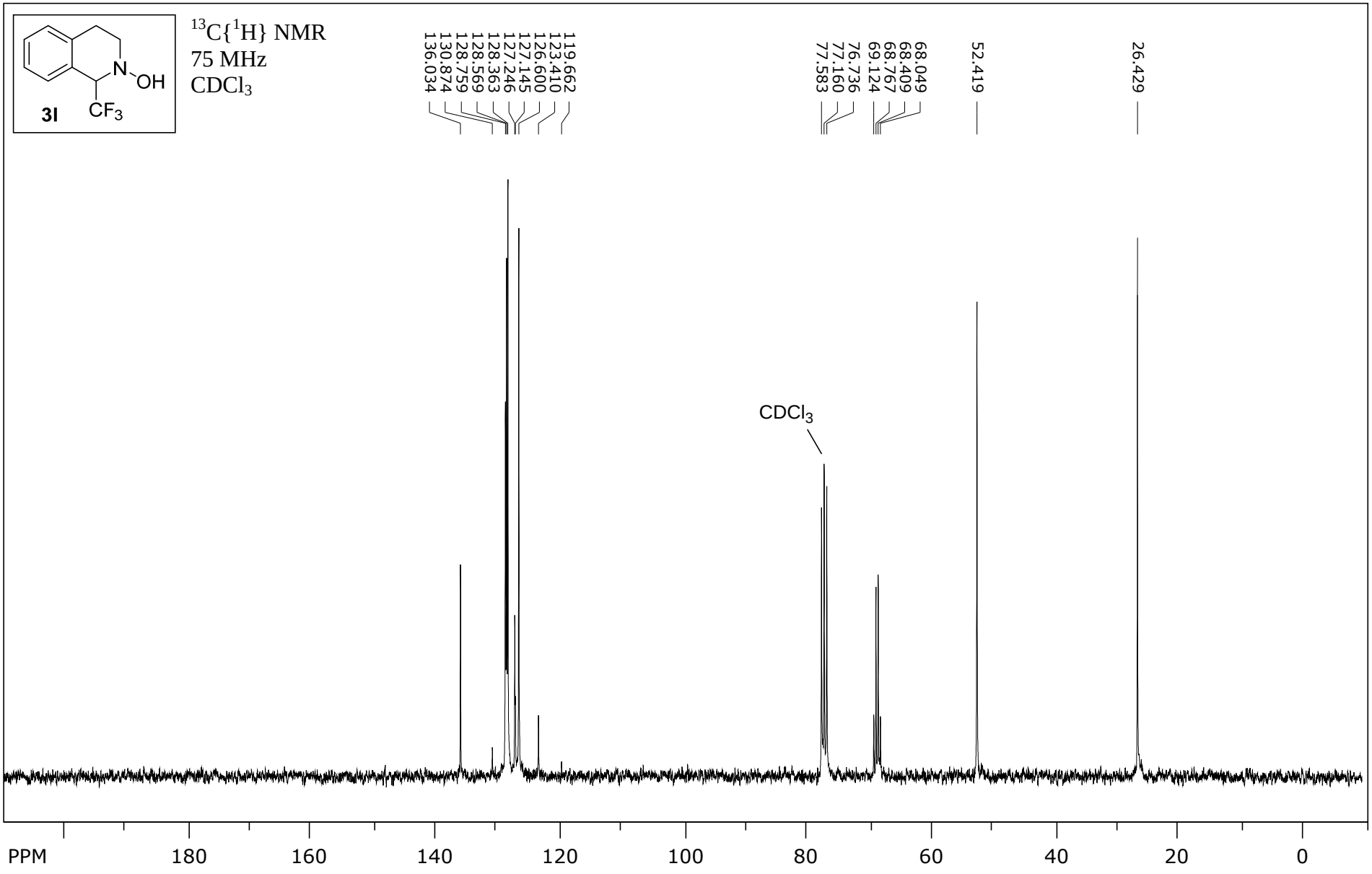

8.577
8.593
7.738
7.717
7.551
7.350
7.340
7.328
7.260
4.628
4.594
4.564
4.530
2.606
HO
N
Me
N
F
F
F
F
CF3
3k
1H NMR
300 MHz
CDCl3
1.000
2.053
1.050
1.045
1.004
3.176
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

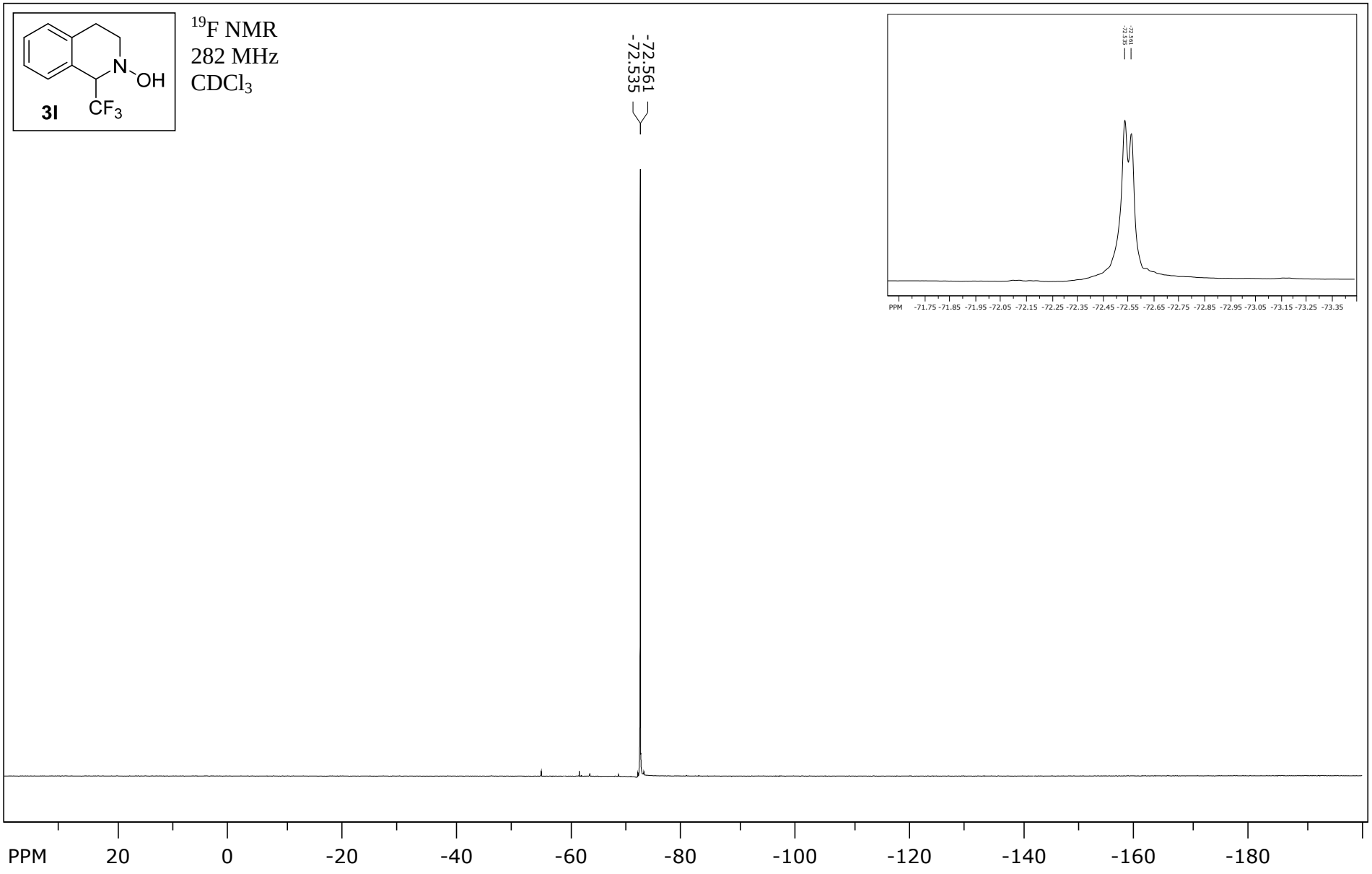


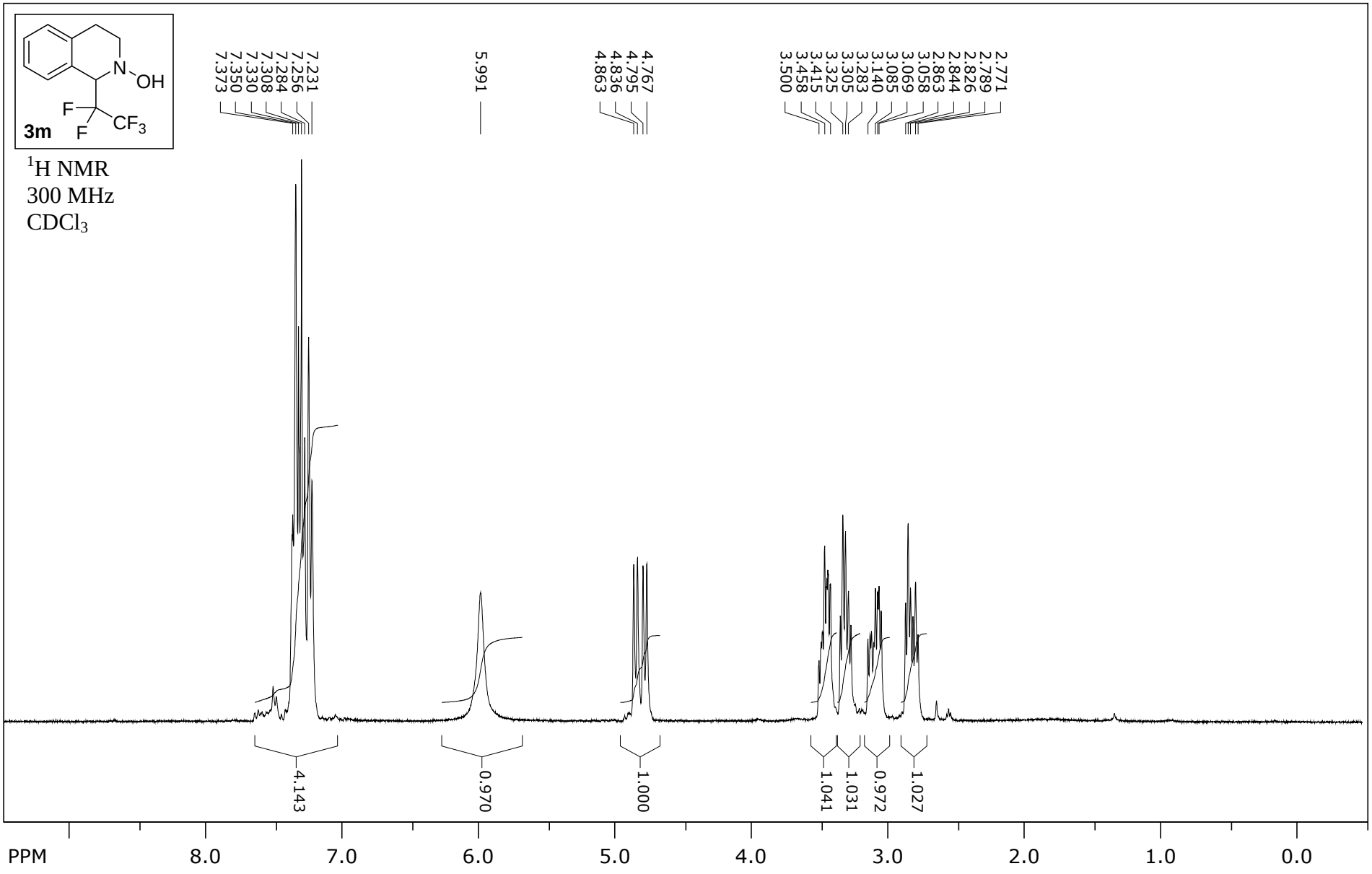
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$

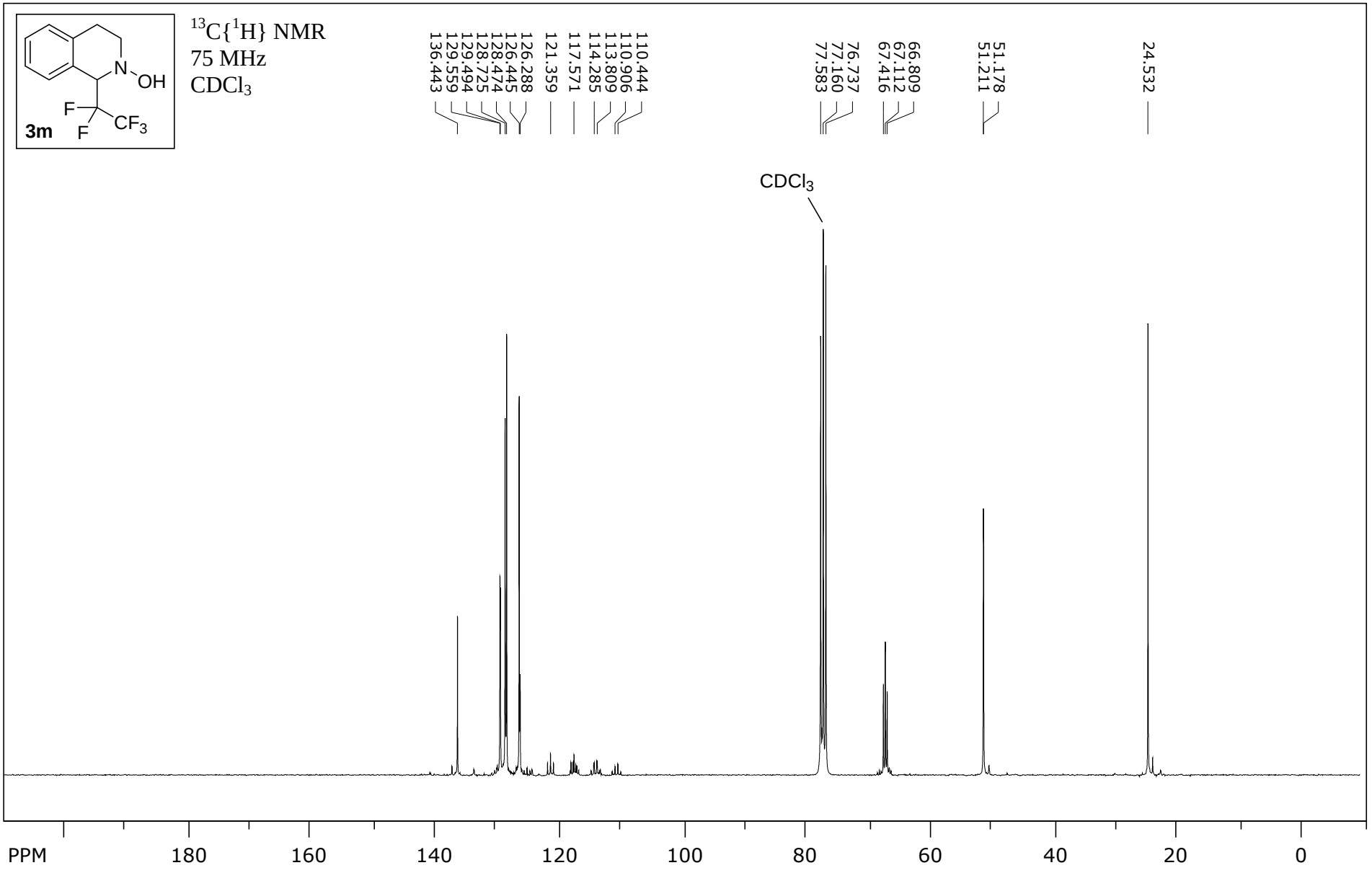

HO
N
Me
F
F
F
F
CF3
N
3k
19F NMR
282 MHz
CDCl3
-81.610
-81.646
-81.683
-112.254
-112.297
-112.341
-112.382
-113.269
-113.307
-113.347
-113.383
-118.866
-118.896
-119.868
-119.905
-124.897
-124.913
-124.935
-124.961
-125.923
-125.946
-125.961
-125.984
-126.857
-126.901
-127.886
-127.935
3.035
1.005
1.000
1.004
0.995
PPM
-30
-50
-70
-90
-110
-130
-150
-170
-190
PPM
-113
-115
-117
-119
-121
-123
-125
-127
-129

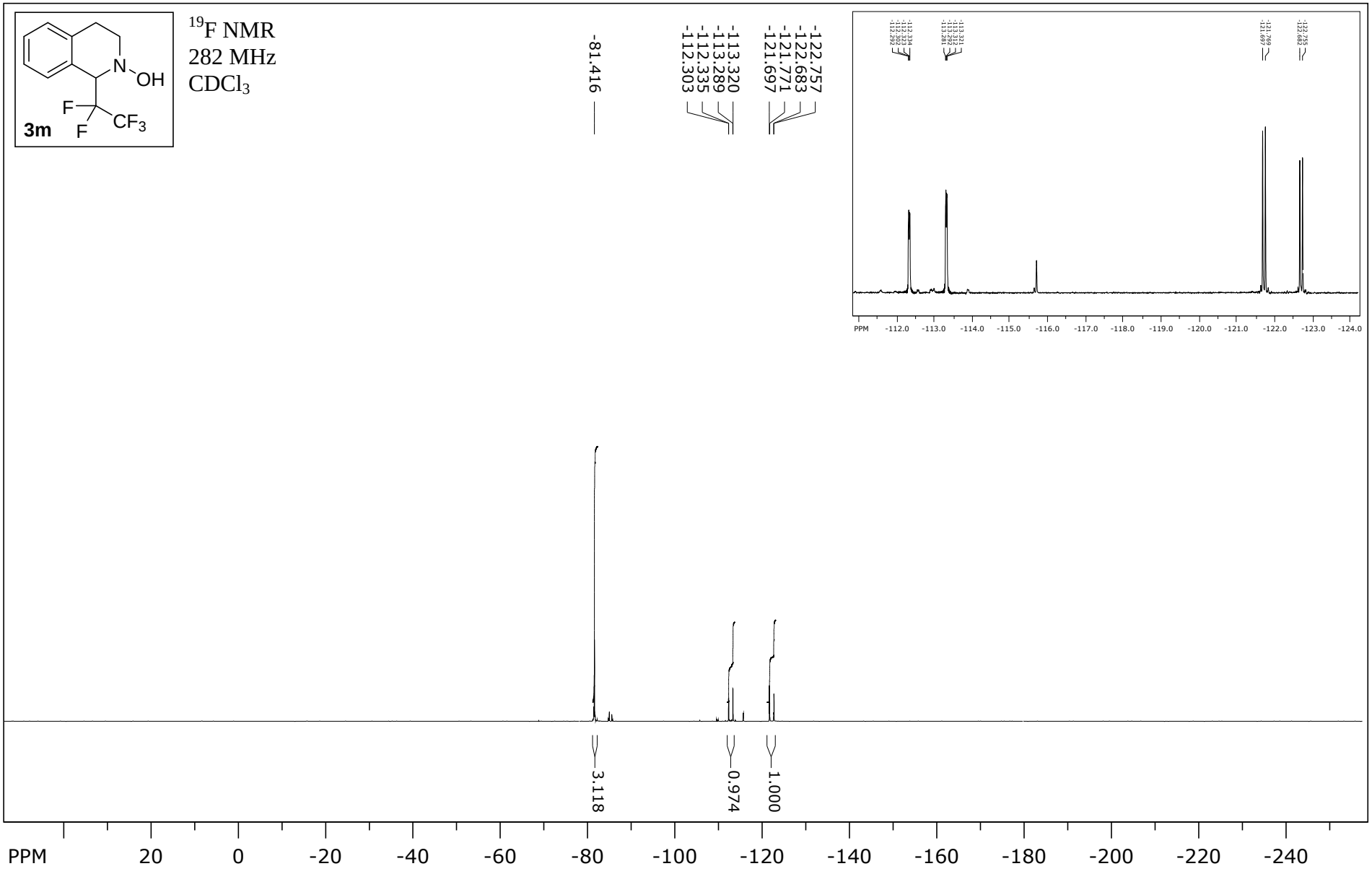

3l
CF3
N
OH
1H NMR
300 MHz
CDCl3
7.412
7.389
7.342
7.326
7.320
7.299
7.251
7.227
4.805
4.779
4.754
4.728
3.599
3.582
3.563
3.544
3.527
3.306
3.291
3.279
3.265
3.254
3.241
3.226
3.006
2.989
2.973
2.946
5.136
1.038
1.064
1.081
2.039
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

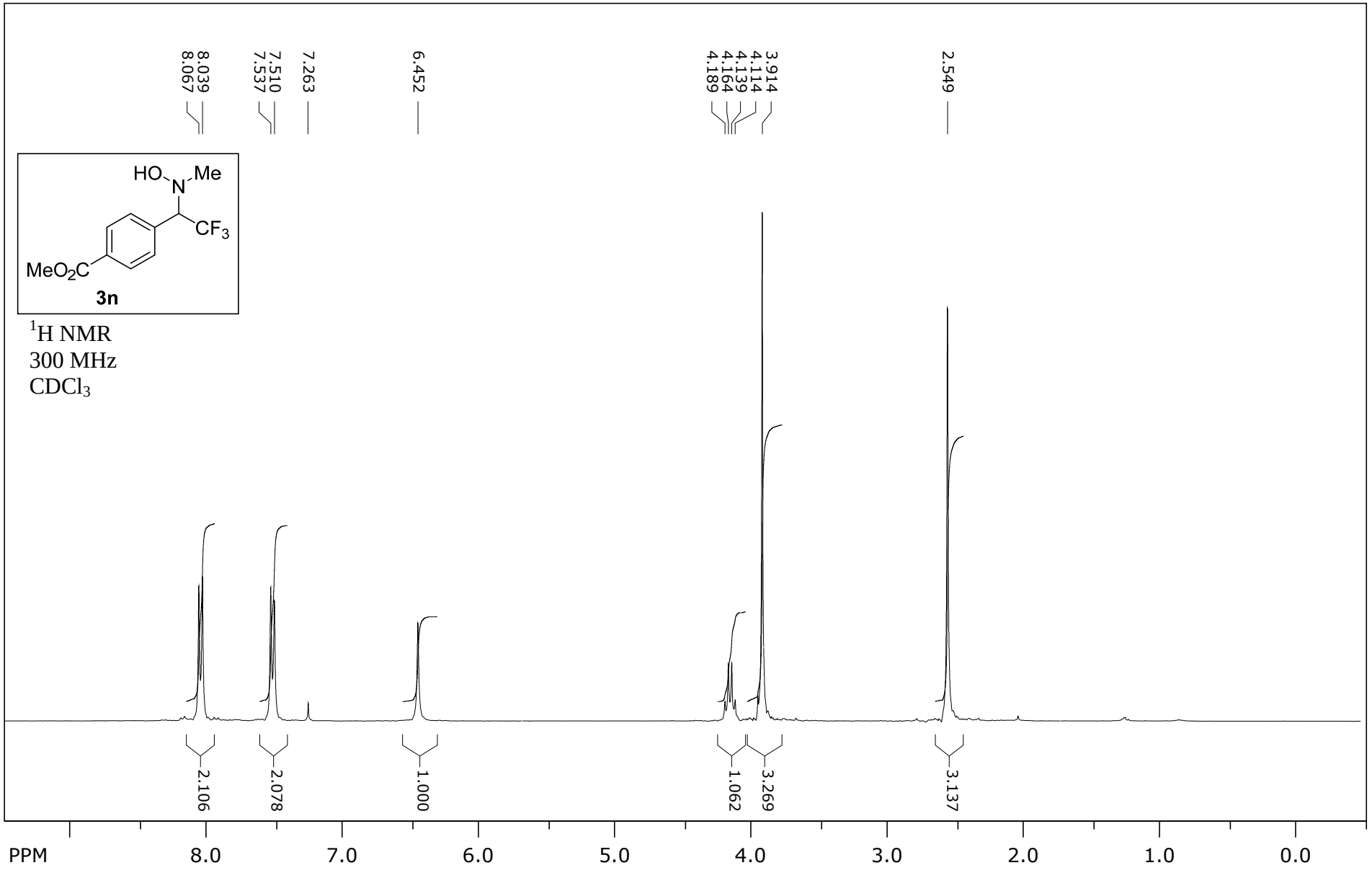

3l
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$
136.034
130.874
128.759
128.569
128.363
127.246
127.145
126.600
123.410
119.662
77.583
77.160
76.736
69.124
68.767
68.409
68.049
52.419
26.429
$CDCl_3$
PPM
180
160
140
120
100
80
60
40
20
0

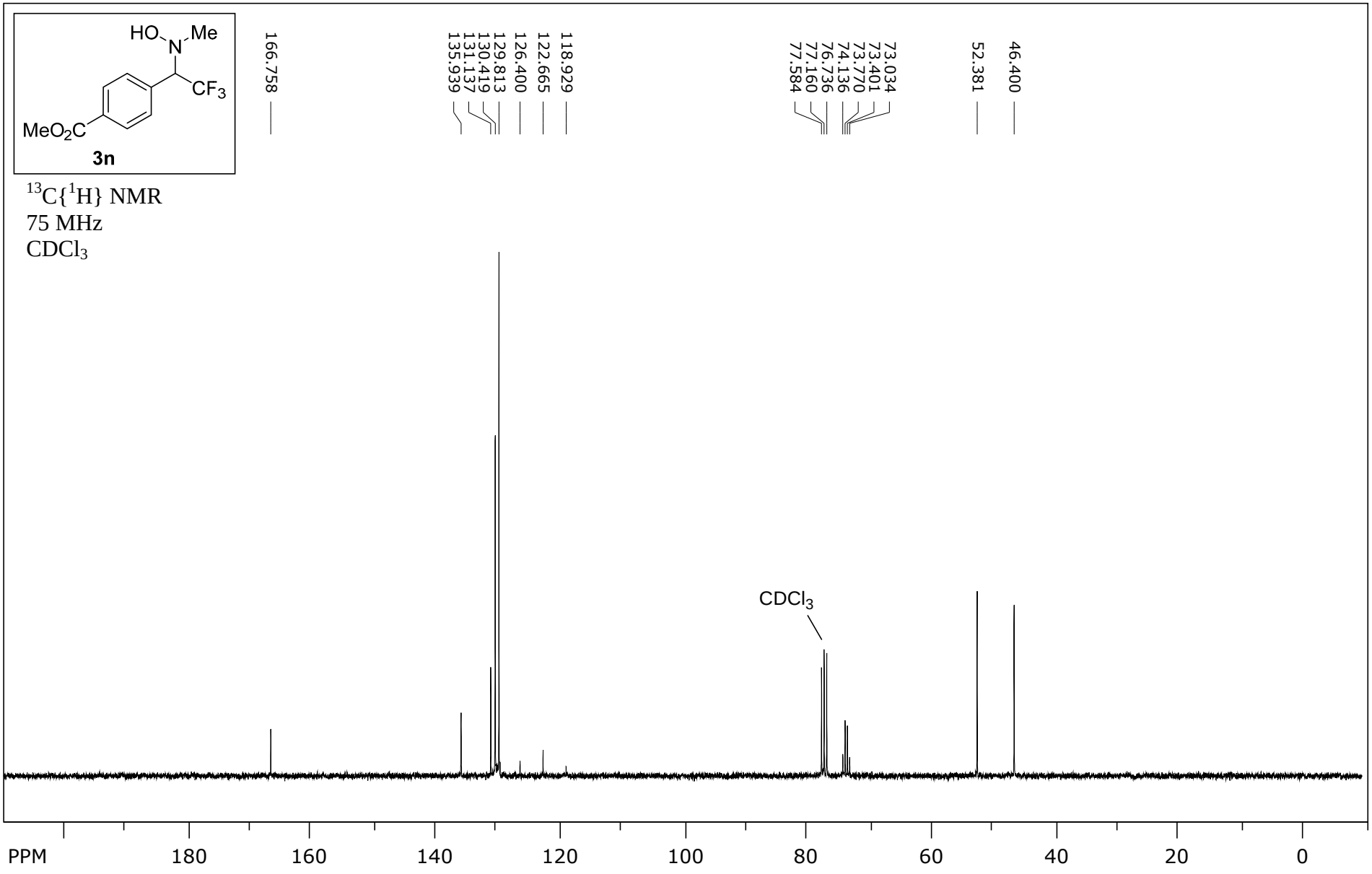

3l
^{19}F NMR
282 MHz
$CDCl_3$
-72.561
-72.535
PPM
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180

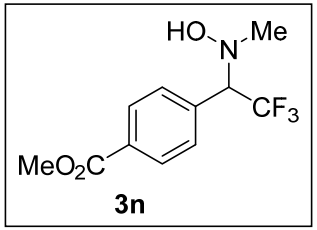

3m
^{1}H NMR
300 MHz
$CDCl_3$
7.373
7.350
7.330
7.308
7.284
7.256
7.231
5.991
4.863
4.836
4.795
4.767
3.500
3.458
3.415
3.325
3.305
3.283
3.140
3.085
3.069
3.058
2.863
2.844
2.826
2.789
2.771
4.143
0.970
1.000
1.041
1.031
0.972
1.027
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0


3m
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$
136.443
129.559
129.494
128.725
128.474
126.445
126.288
121.359
117.571
114.285
113.809
110.906
110.444
77.583
77.160
76.737
67.416
67.112
66.809
51.211
51.178
24.532
$CDCl_3$
PPM
180
160
140
120
100
80
60
40
20
0


3m
^{19}F NMR
282 MHz
$CDCl_3$
-81.416
-112.303
-112.335
-113.289
-113.320
-121.697
-121.771
-122.683
-122.757
3.118
0.974
1.000
PPM
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
-220
-240

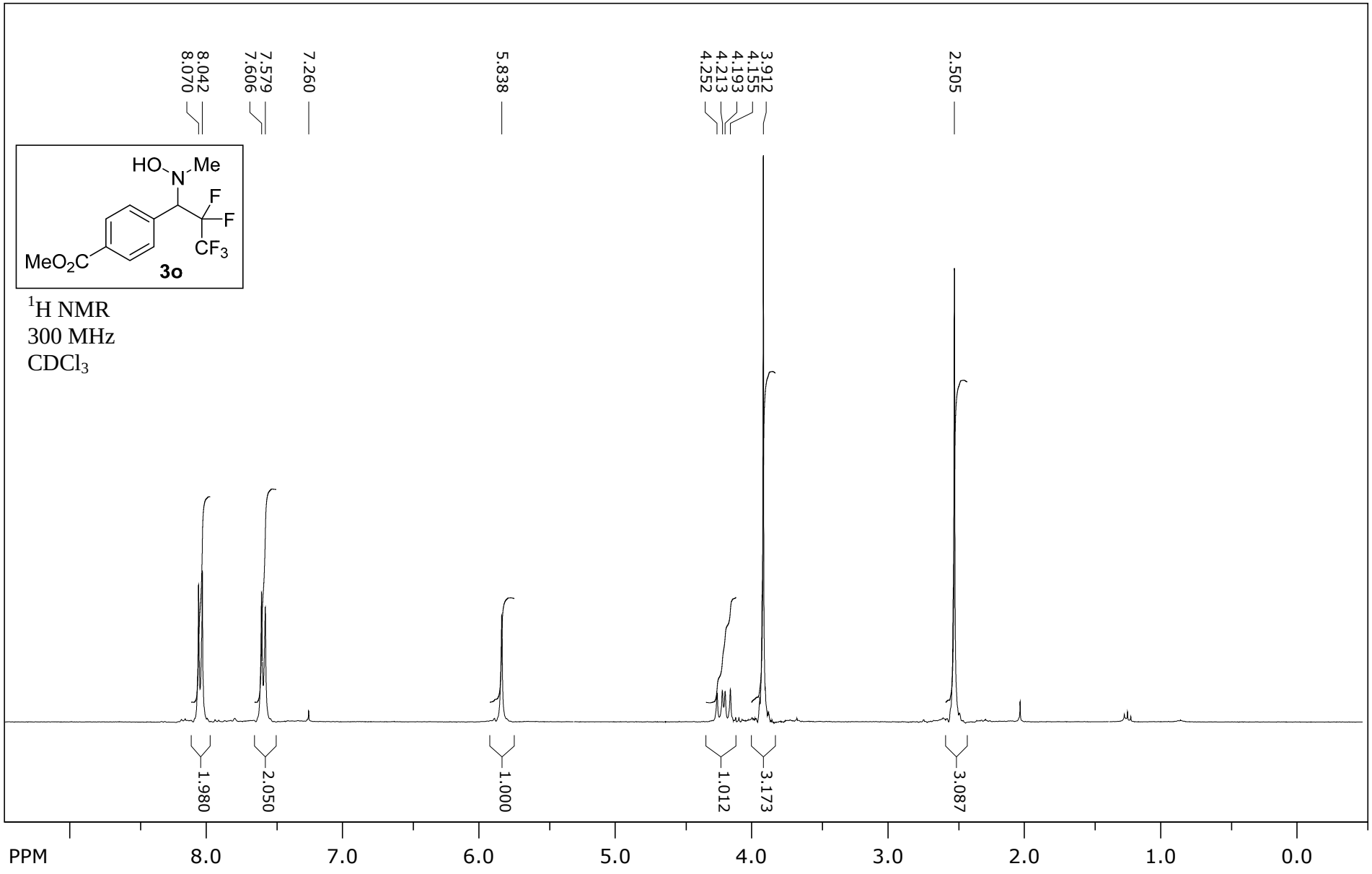

8.039
8.067
7.510
7.537
7.263
6.452
4.189
4.164
4.139
4.114
3.914
2.549
HO
N
Me
CF3
MeO2C
3n
1H NMR
300 MHz
CDCl3
2.106
2.078
1.000
1.062
3.269
3.137
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

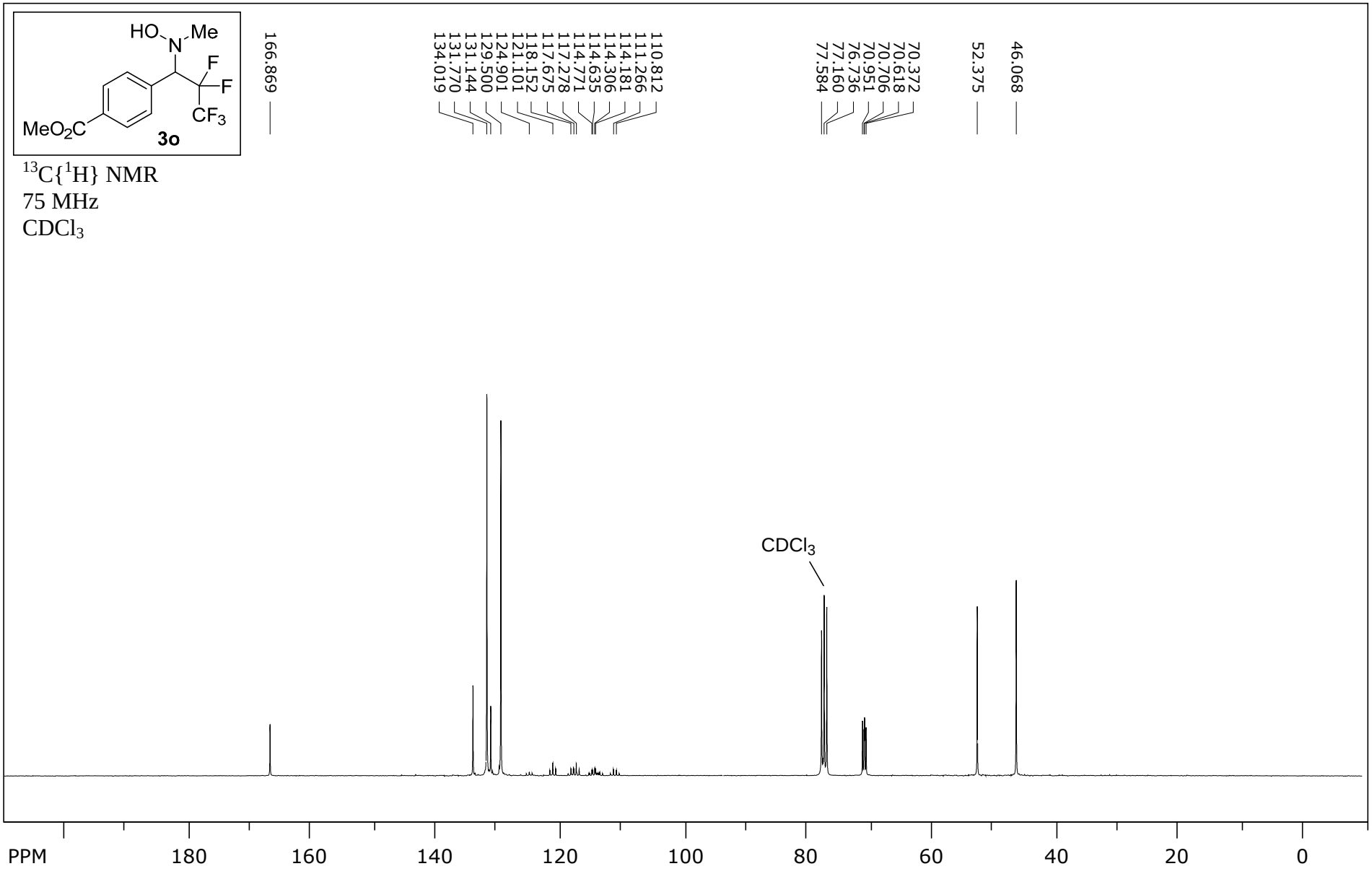

HO
N
Me
CF3
MeO2C
3n
166.758
135.939
131.137
130.419
129.813
126.400
122.665
118.929
77.584
77.160
76.736
74.136
73.770
73.401
73.034
52.381
46.400
13C{1H} NMR
75 MHz
CDCl3
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0



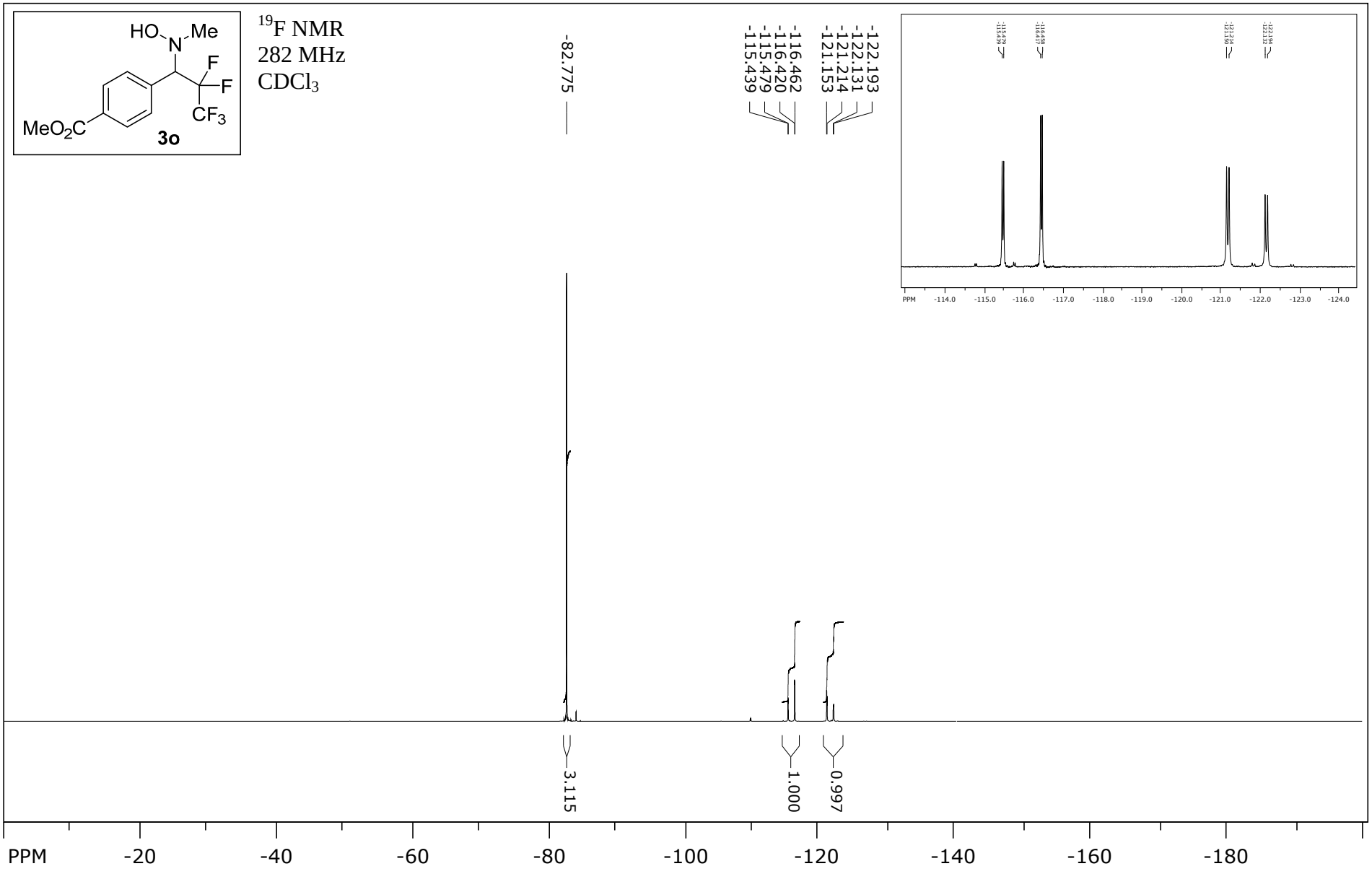
3n

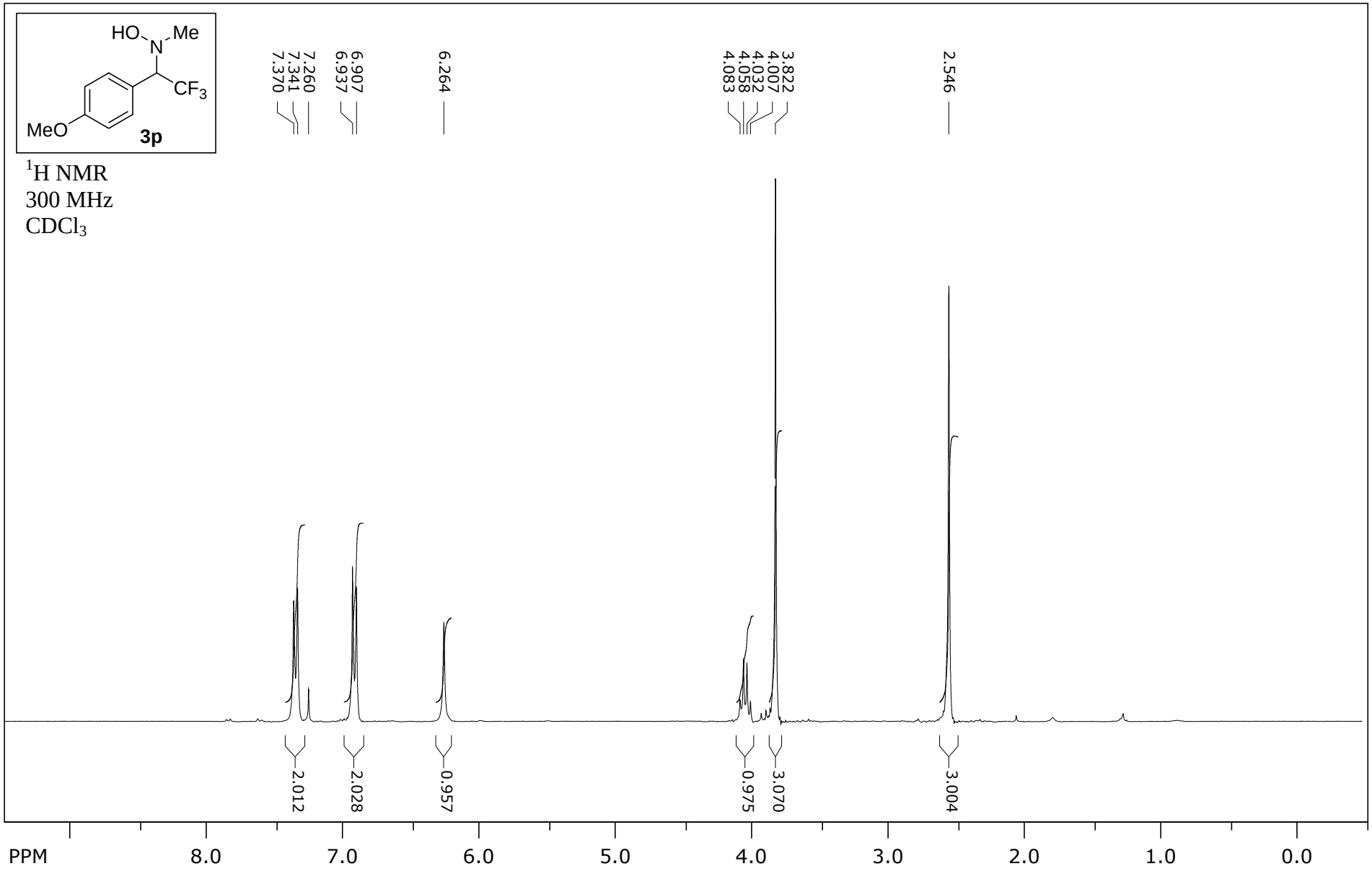
^{19}F NMR
282 MHz
$CDCl_3$


8.070
8.042
7.606
7.579
7.260
5.838
4.252
4.213
4.193
4.155
3.912
2.505
HO
N
Me
F
F
CF3
MeO2C
3o
1H NMR
300 MHz
CDCl3
1.980
2.050
1.000
1.012
3.173
3.087
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

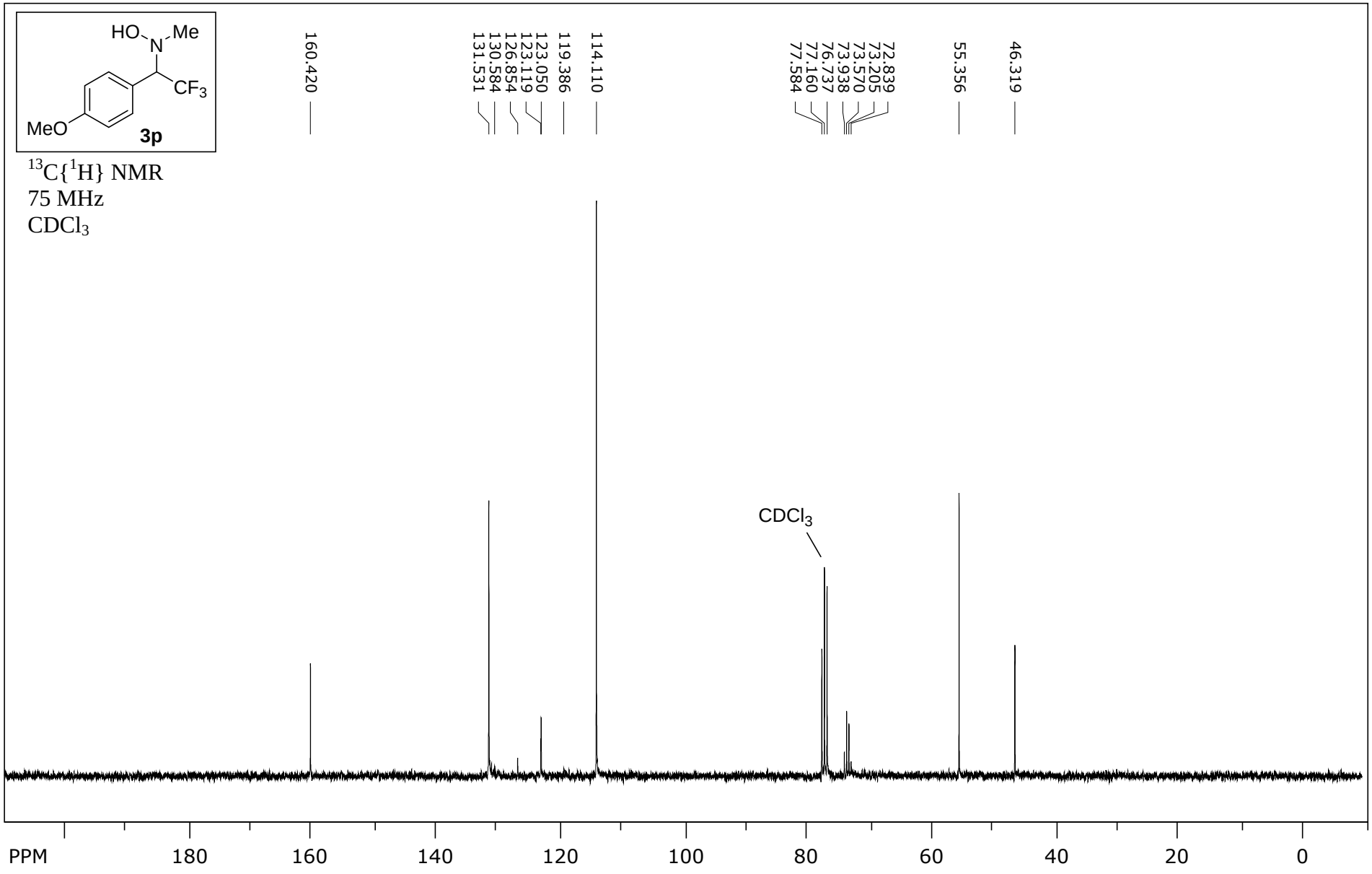


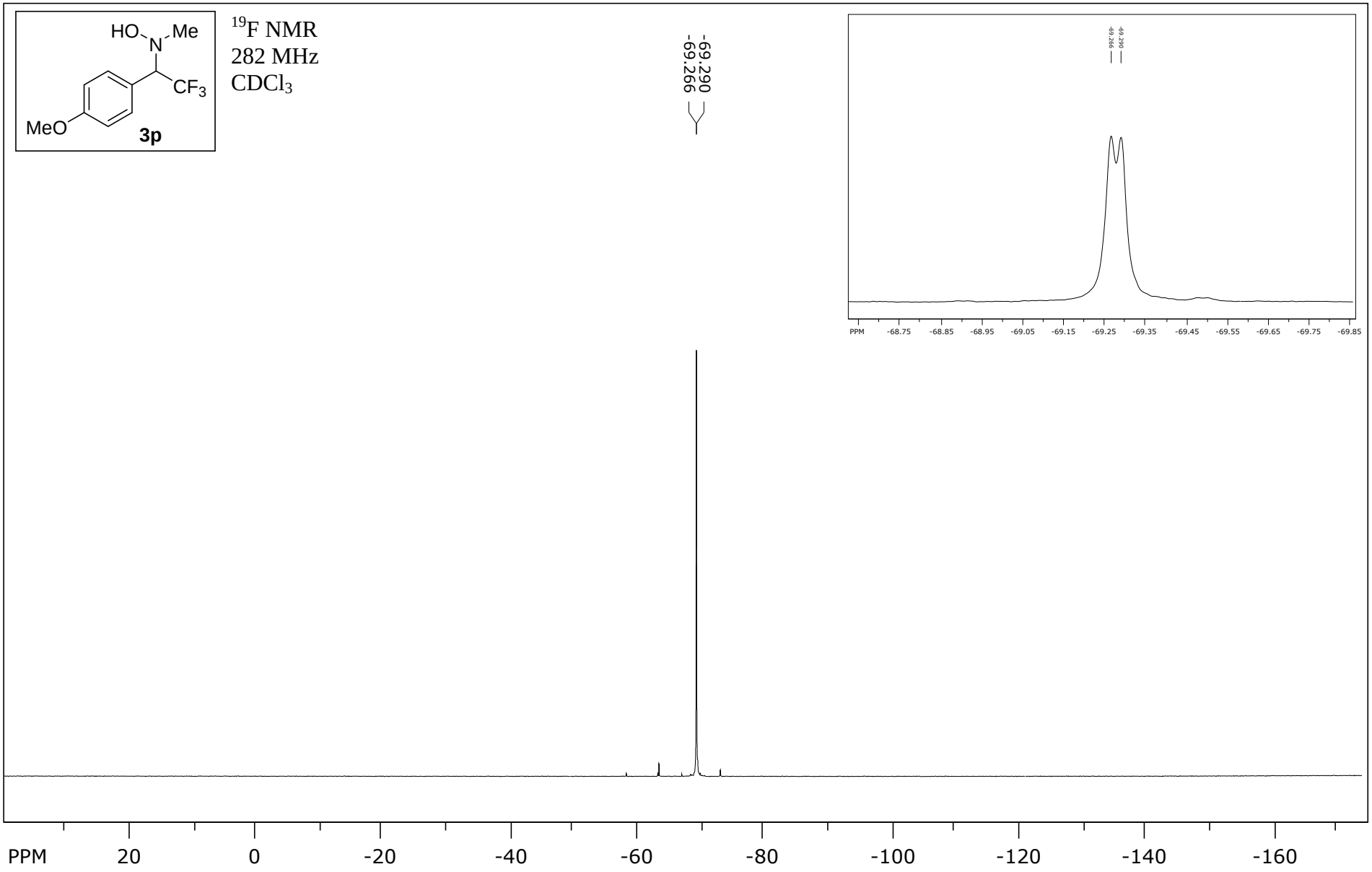
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$

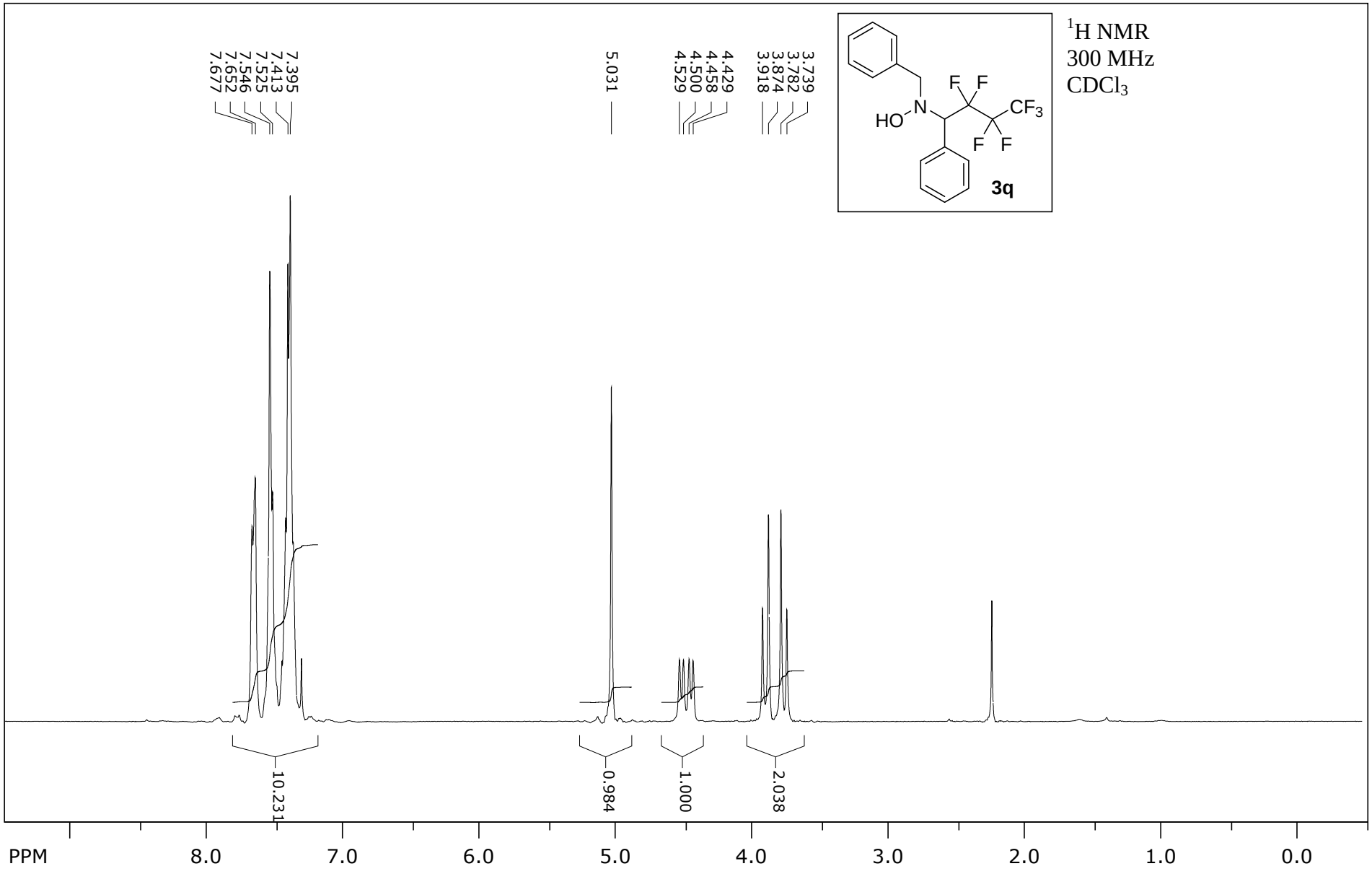

HO
N
Me
F
F
CF3
MeO2C
3o
19F NMR
282 MHz
CDCl3
-82.775
-115.439
-115.479
-116.420
-116.462
-121.153
-121.214
-122.131
-122.193
3.115
1.000
0.997
PPM
-20
-40
-60
-80
-100
-120
-140
-160
-180

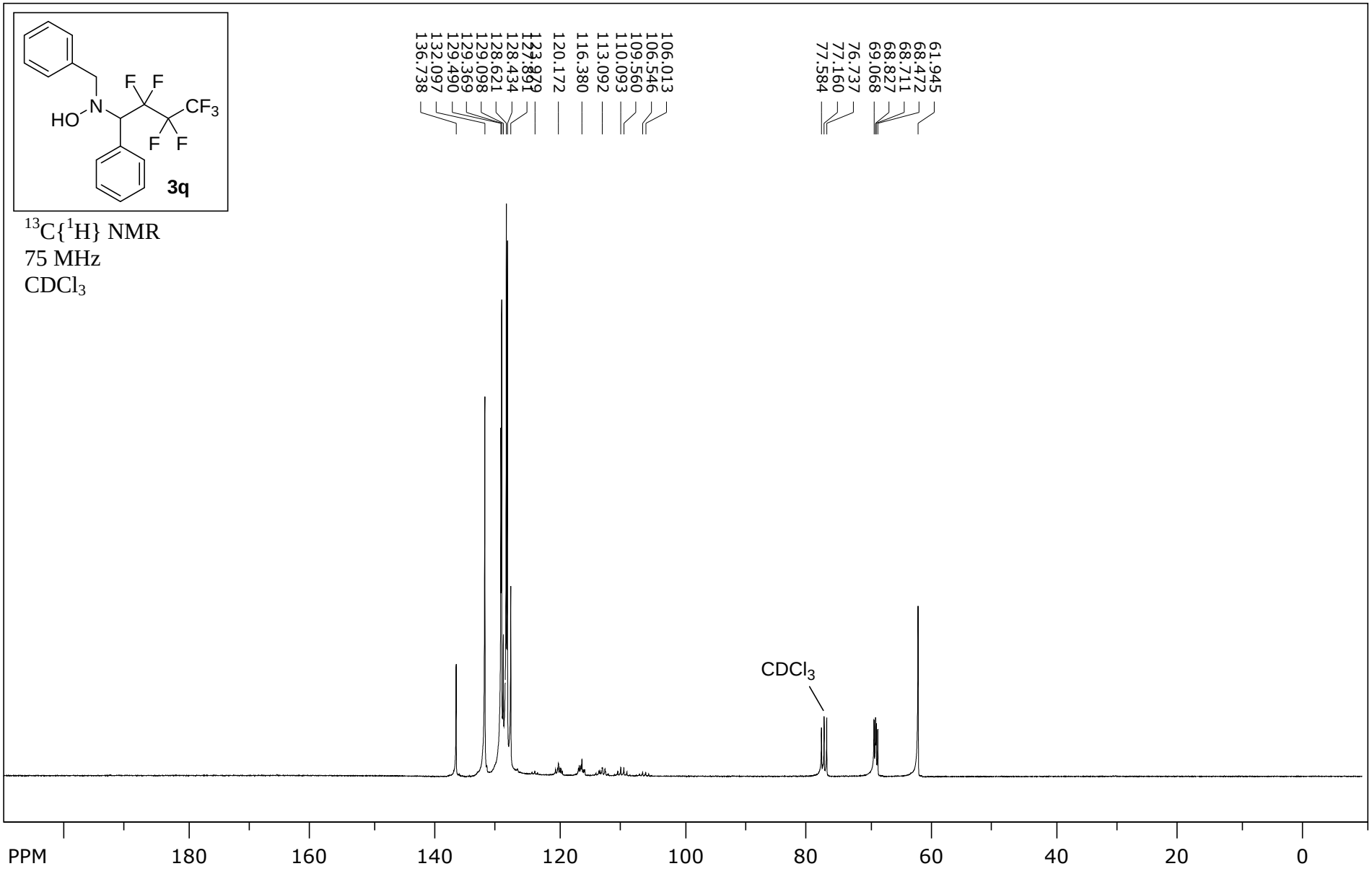


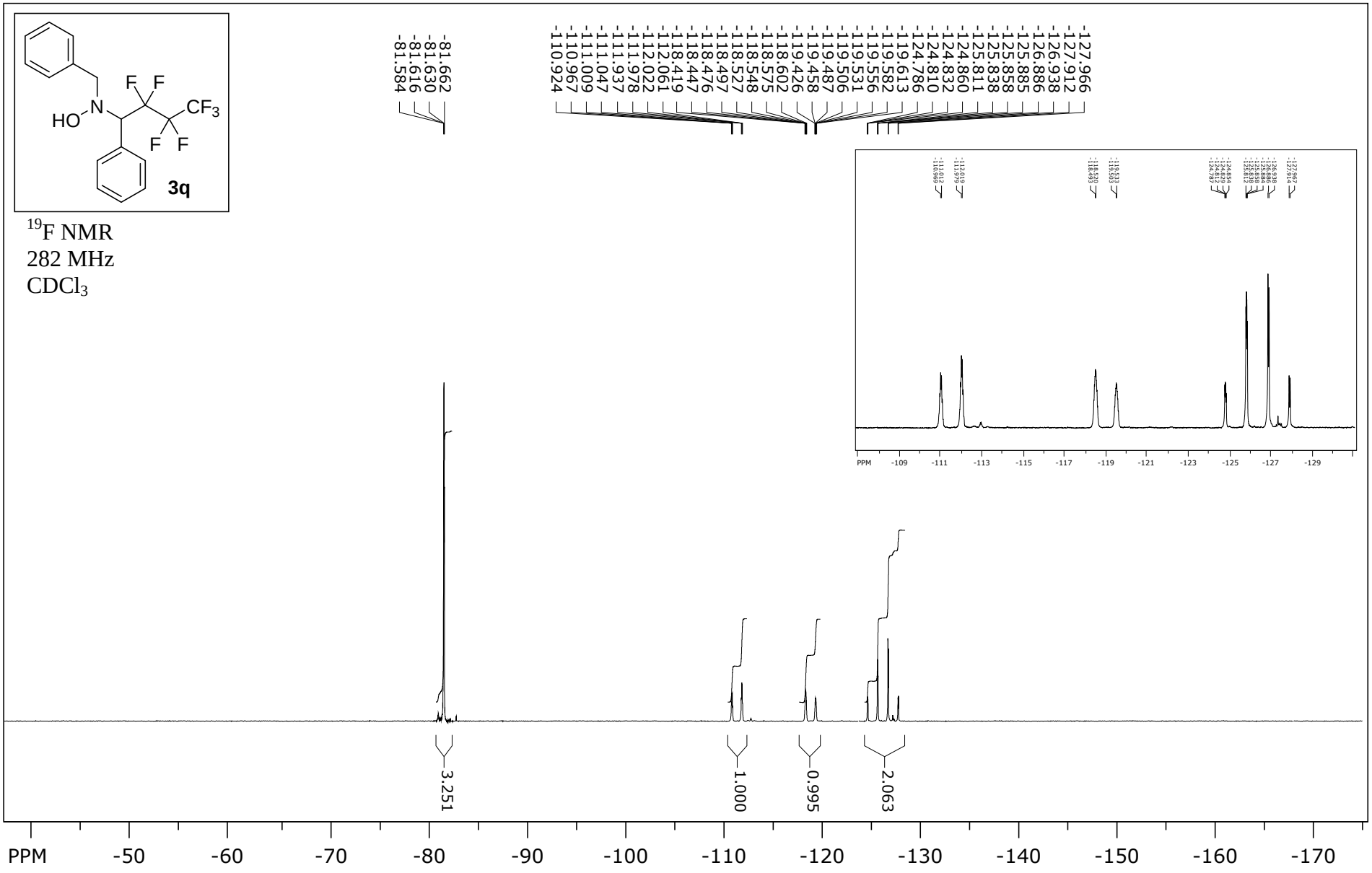
^{1}H NMR
300 MHz
$CDCl_3$

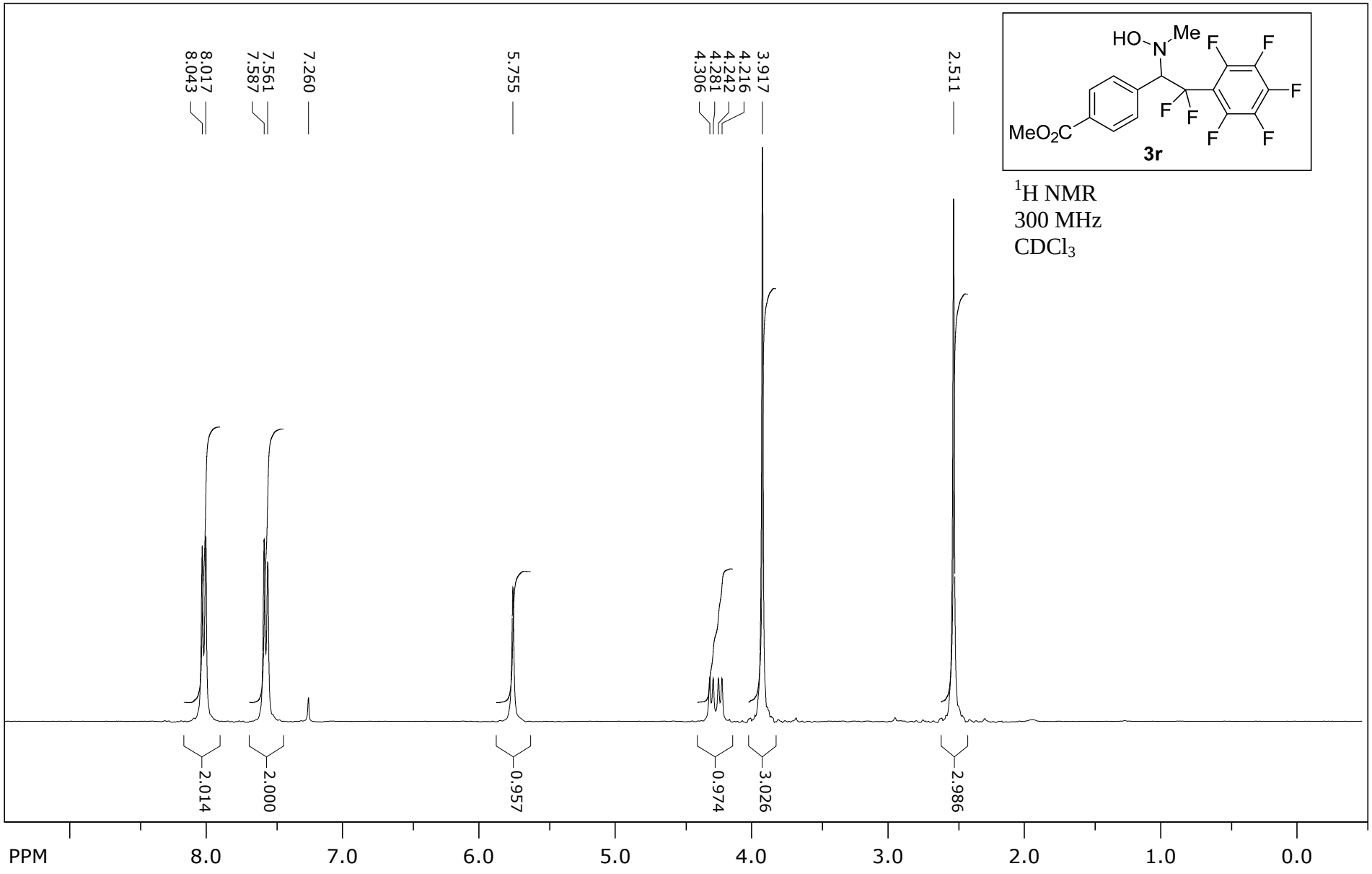

HO
N
Me
CF3
MeO
3p
160.420
131.531
130.584
126.854
123.119
123.050
119.386
114.110
77.584
77.160
76.737
73.938
73.570
73.205
72.839
55.356
46.319
13C{1H} NMR
75 MHz
CDCl3
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0

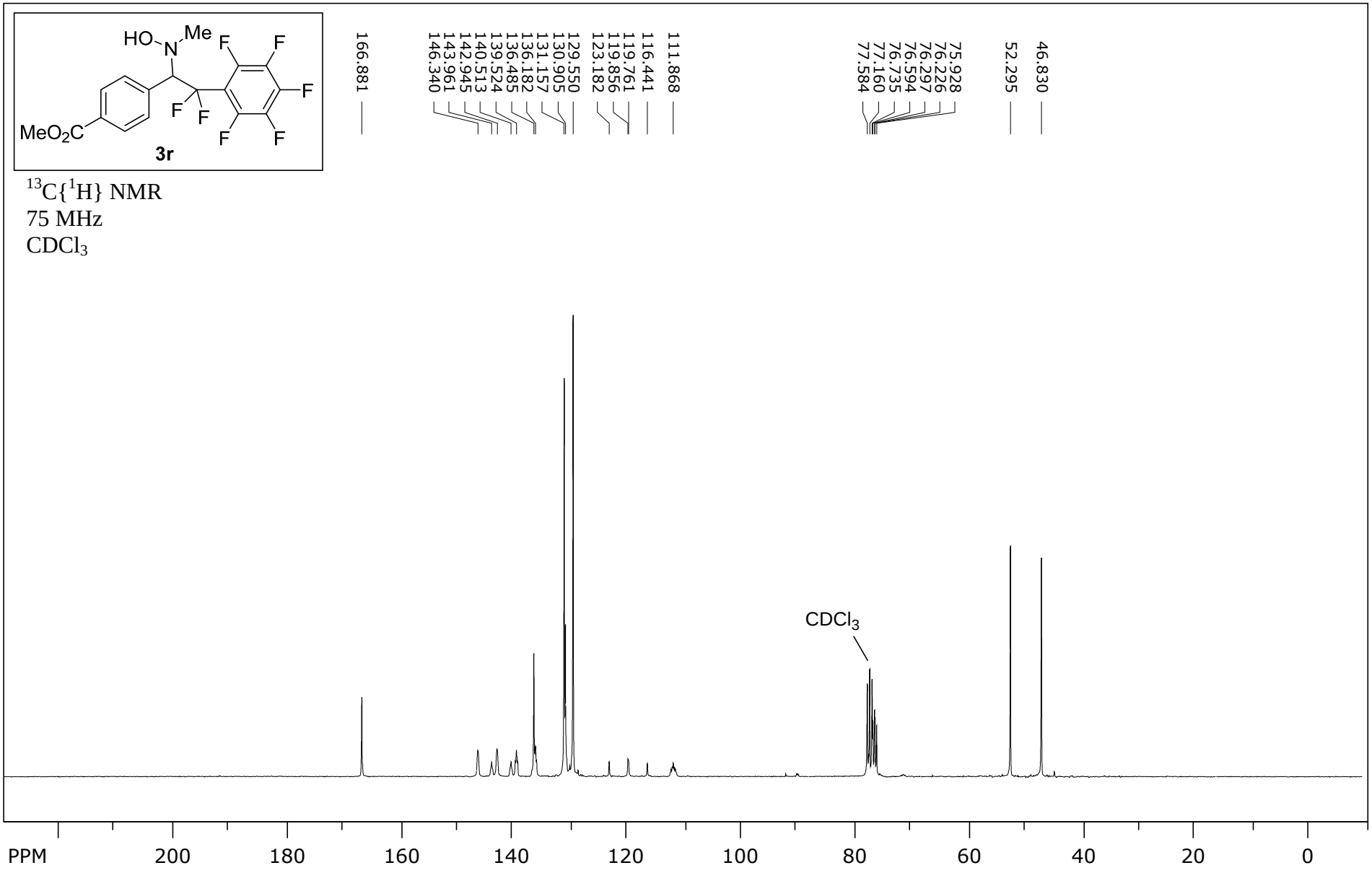

HO
N
Me
CF3
MeO
3p
19F NMR
282 MHz
CDCl3
-69.290
-69.266
PPM
20
0
-20
-40
-60
-80
-100
-120
-140
-160


7.677
7.652
7.546
7.525
7.413
7.395
5.031
4.529
4.500
4.458
4.429
3.918
3.874
3.782
3.739
10.231
0.984
1.000
2.038
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
HO
N
F
F
CF3
F
F
3q
1H NMR
300 MHz
CDCl3

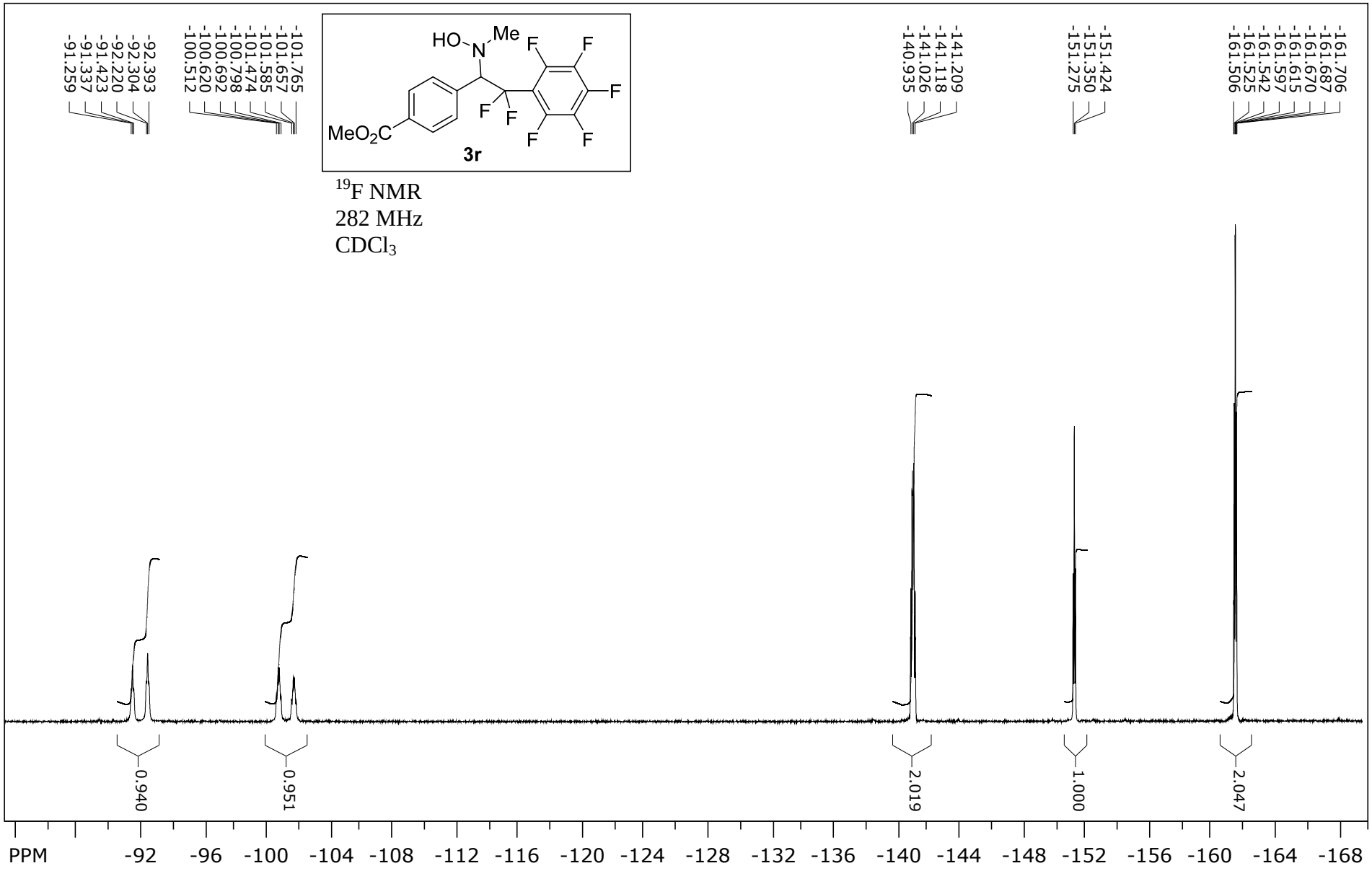

3q
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$
136.738
132.097
129.490
129.369
129.098
128.621
128.434
120.172
116.380
113.092
110.093
109.560
106.546
106.013
77.584
76.737
77.160
69.068
68.827
68.711
68.472
61.945
$CDCl_3$
PPM
180
160
140
120
100
80
60
40
20
0


3q
^{19}F NMR
282 MHz
$CDCl_3$
-81.584
-81.616
-81.630
-81.662
-110.924
-110.967
-111.009
-111.047
-111.937
-111.978
-112.022
-112.061
-118.419
-118.447
-118.476
-118.497
-118.527
-118.548
-118.575
-118.602
-119.426
-119.458
-119.487
-119.506
-119.531
-119.556
-119.582
-119.613
-124.786
-124.810
-124.832
-124.860
-125.811
-125.838
-125.858
-125.885
-126.886
-126.938
-127.912
-127.966
3.251
1.000
0.995
2.063
PPM
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170

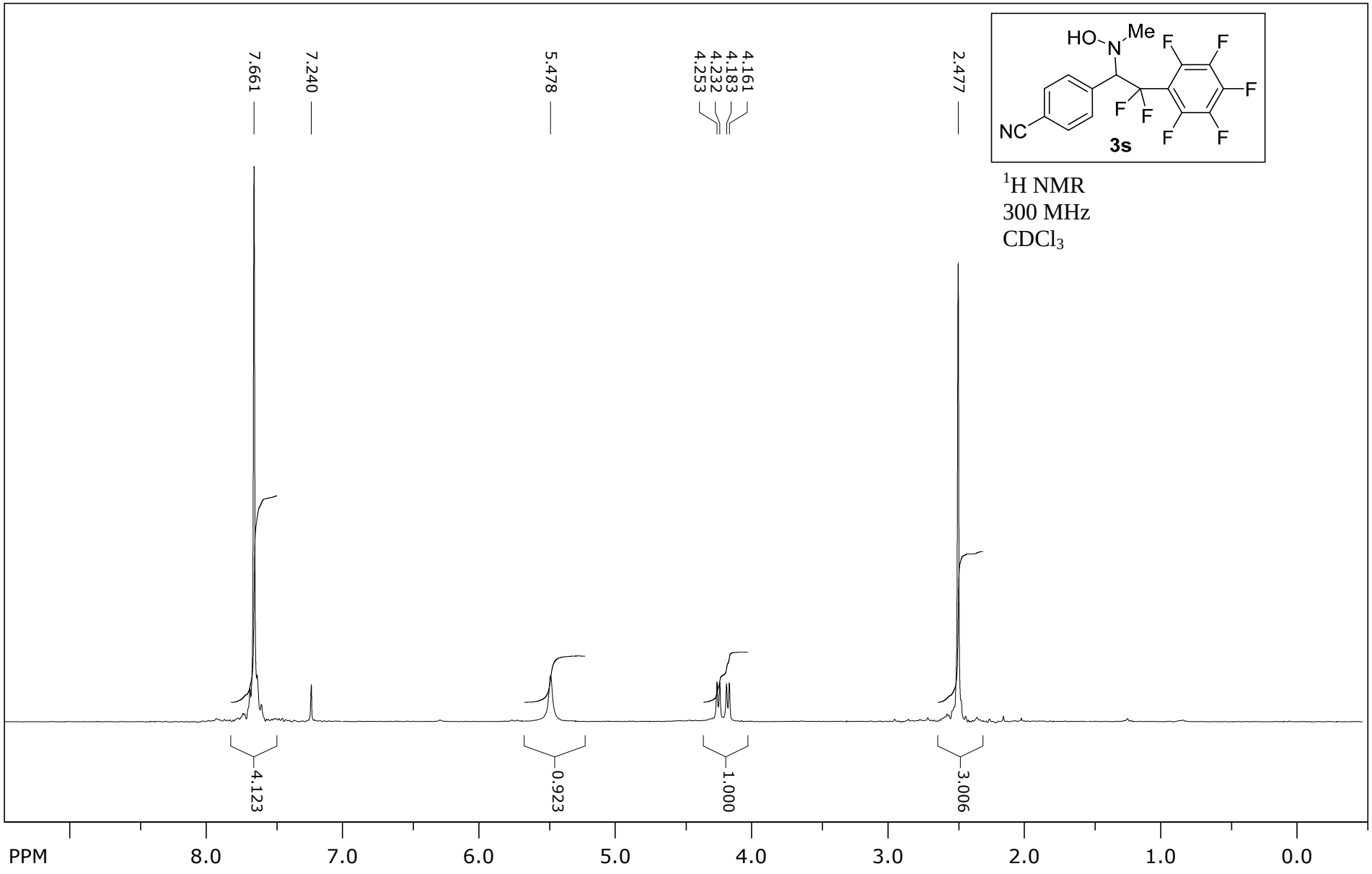

8.017
8.043
7.561
7.587
7.260
5.755
4.306
4.281
4.242
4.216
3.917
2.511
2.014
2.000
0.957
0.974
3.026
2.986
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
HO
N
Me
F
F
F
F
F
F
F
MeO2C
3r
1H NMR
300 MHz
CDCl3

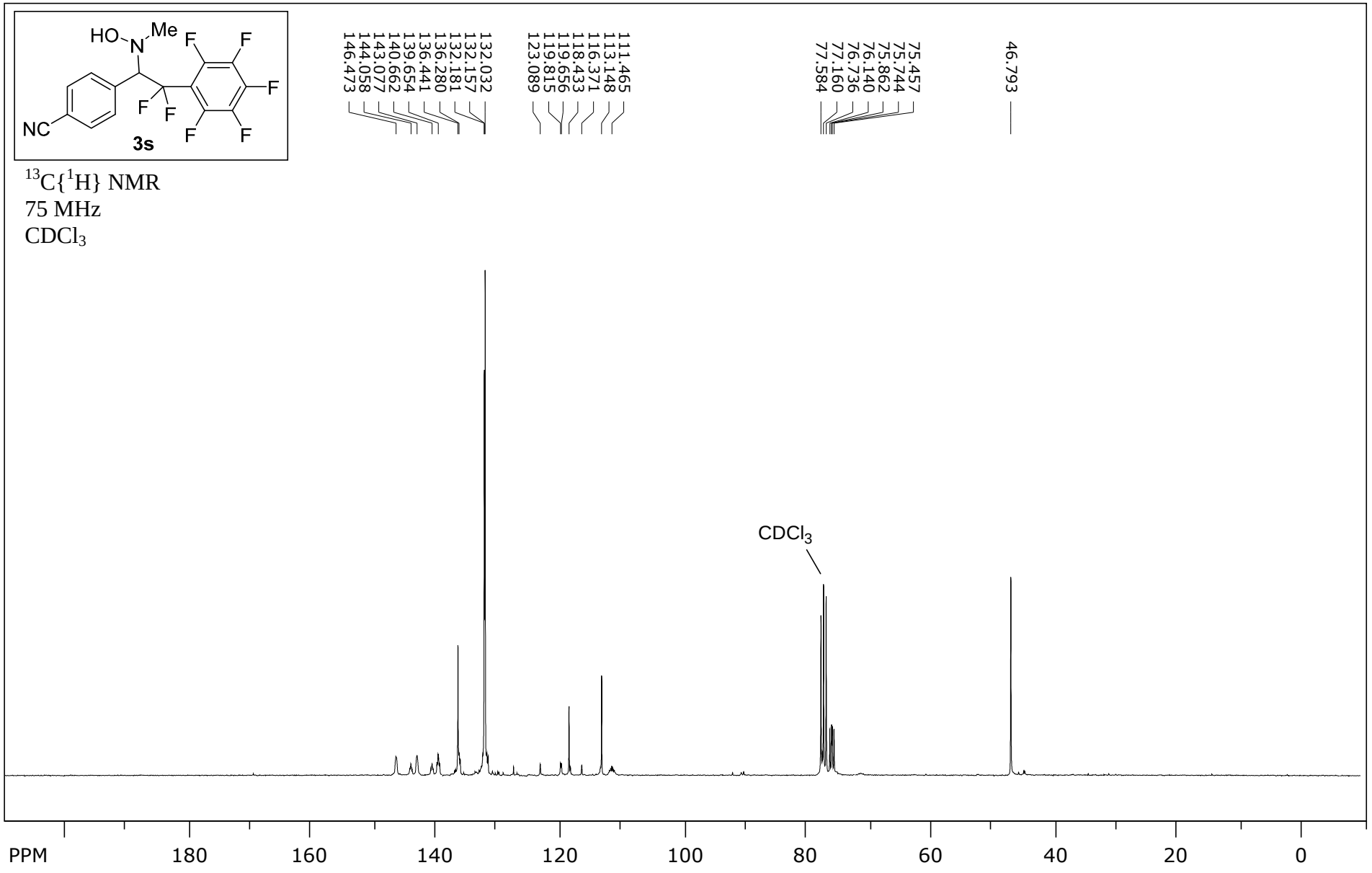


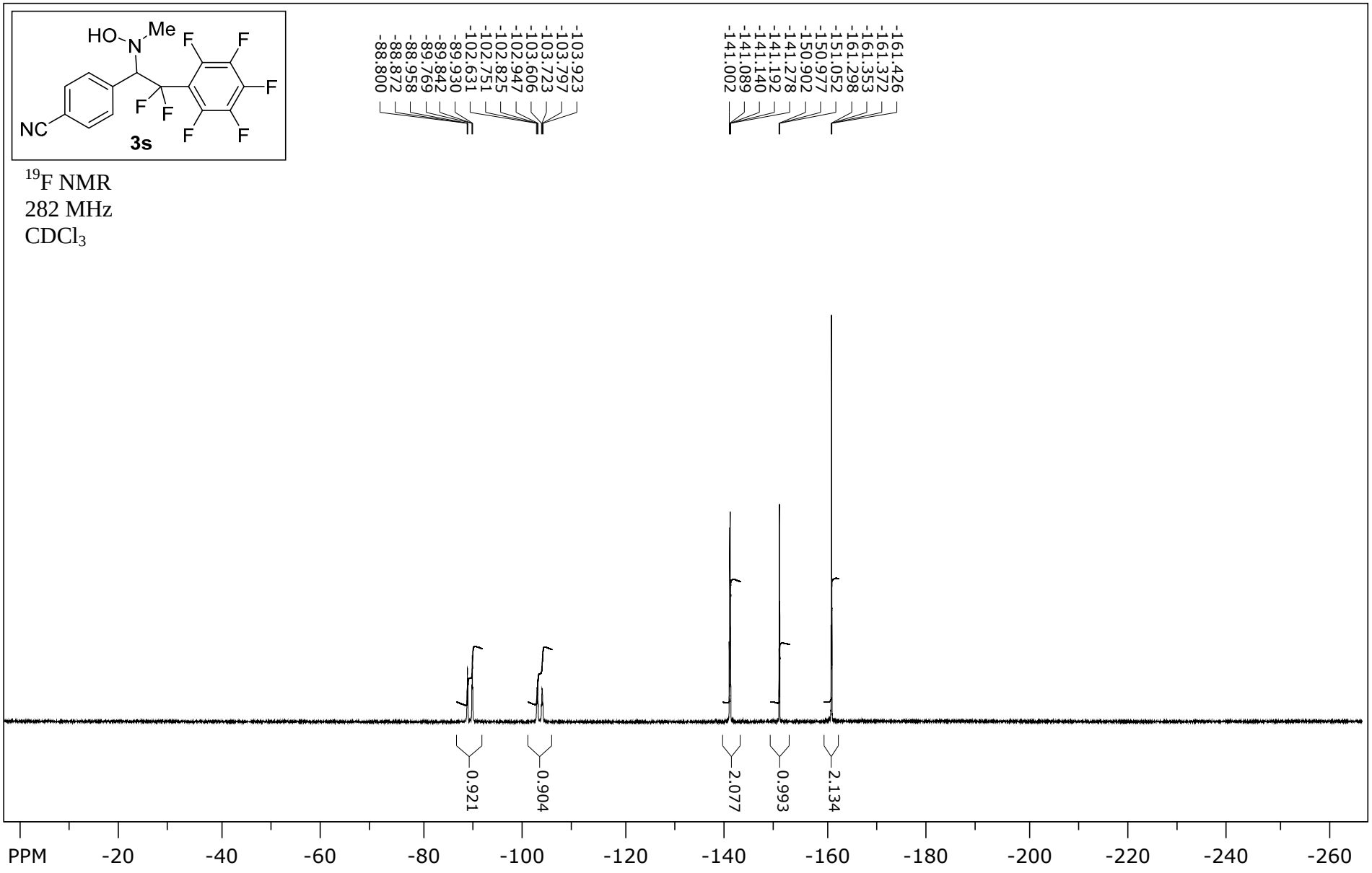
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$



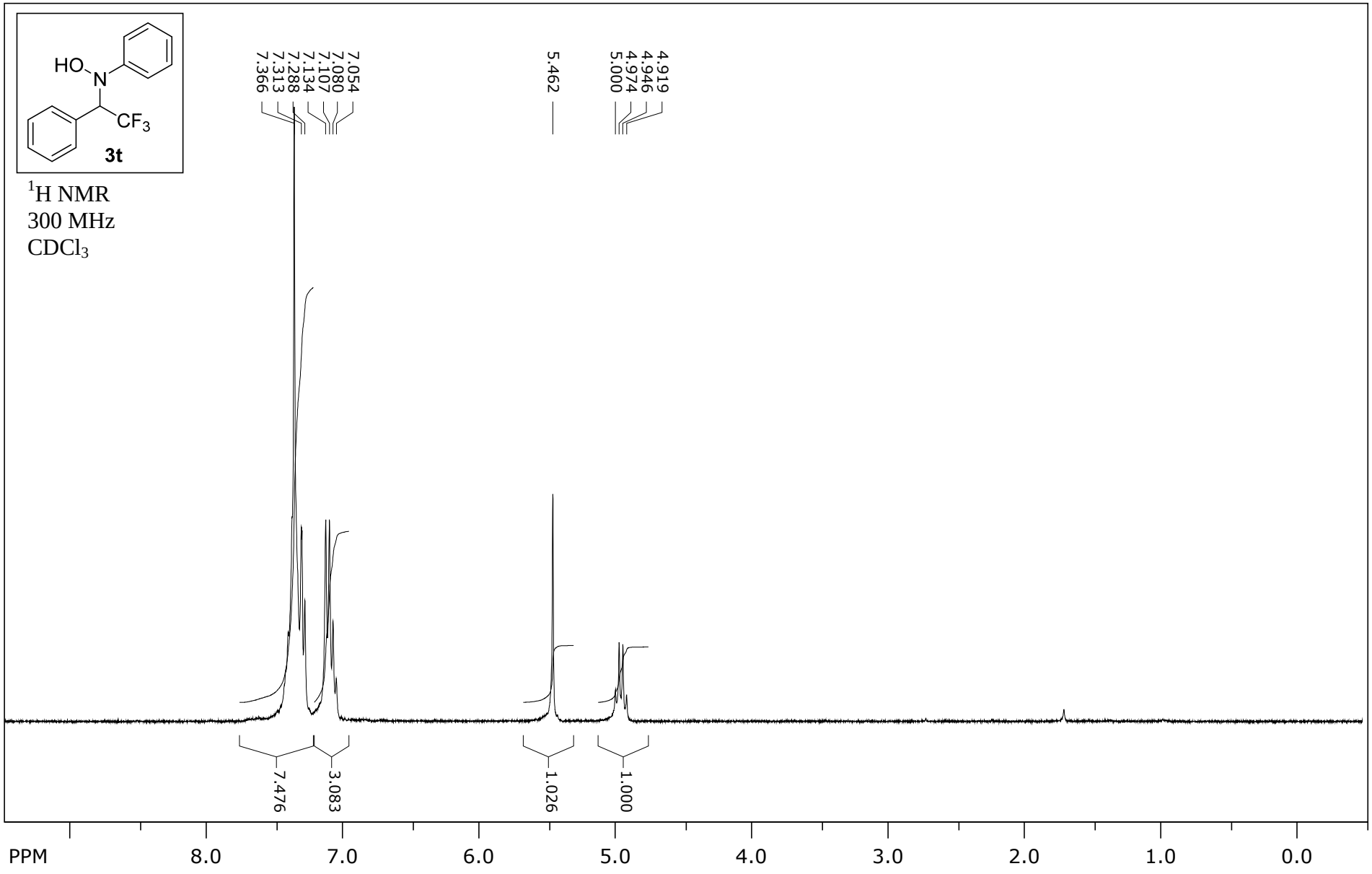
^{19}F NMR
282 MHz
$CDCl_3$

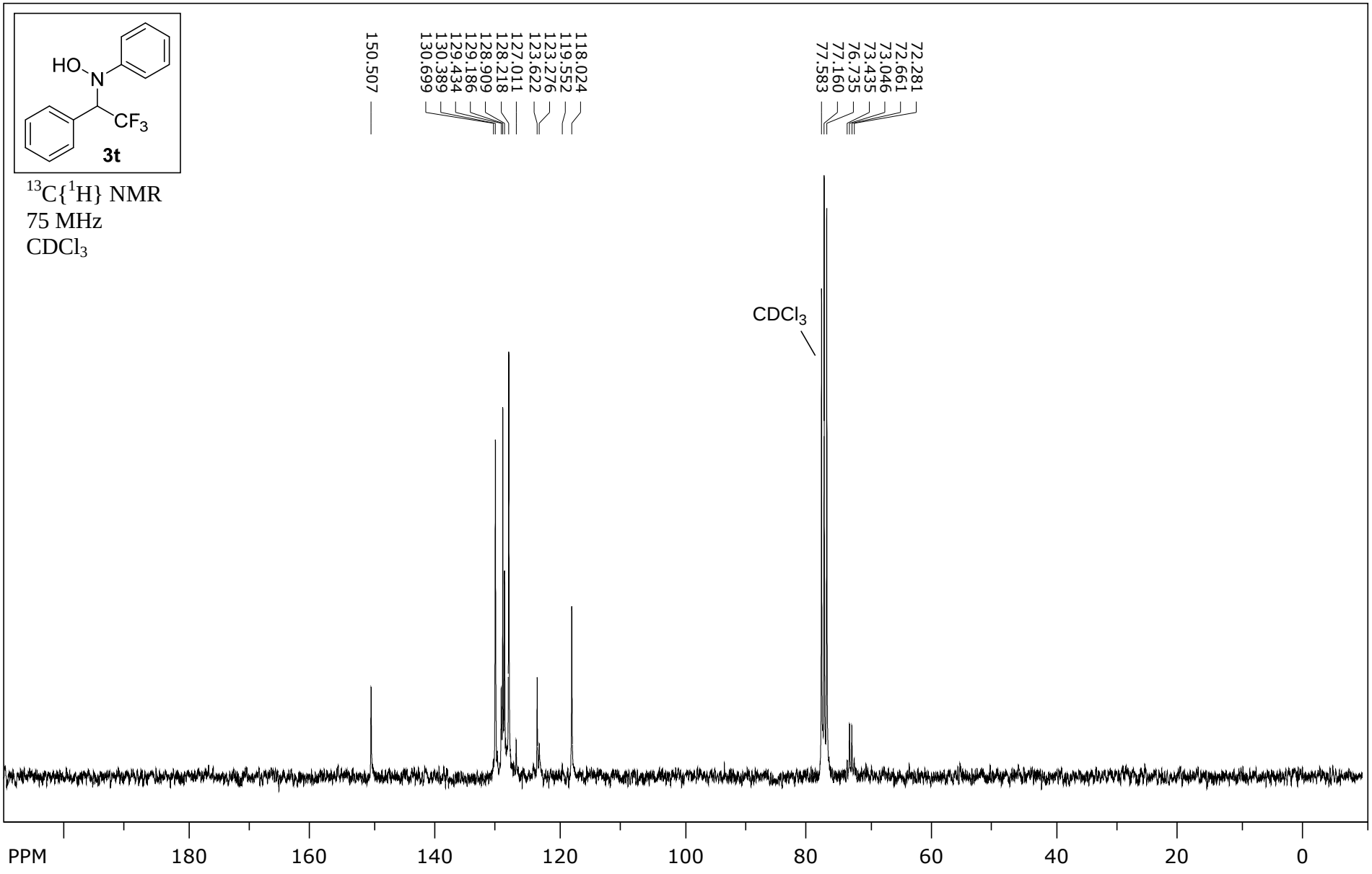

7.661
7.240
5.478
4.253
4.232
4.183
4.161
2.477
HO
N
Me
F
F
F
F
F
F
F
F
NC
3s
1H NMR
300 MHz
CDCl3
4.123
0.923
1.000
3.006
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0


HO
N
Me
F
F
F
F
F
F
NC
3s
146.473
144.058
143.077
140.662
139.654
136.441
136.280
132.181
132.157
132.032
123.089
119.815
119.656
118.433
116.371
113.148
111.465
77.584
77.160
76.736
76.140
75.862
75.744
75.457
46.793
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$
$CDCl_3$
PPM
180
160
140
120
100
80
60
40
20
0

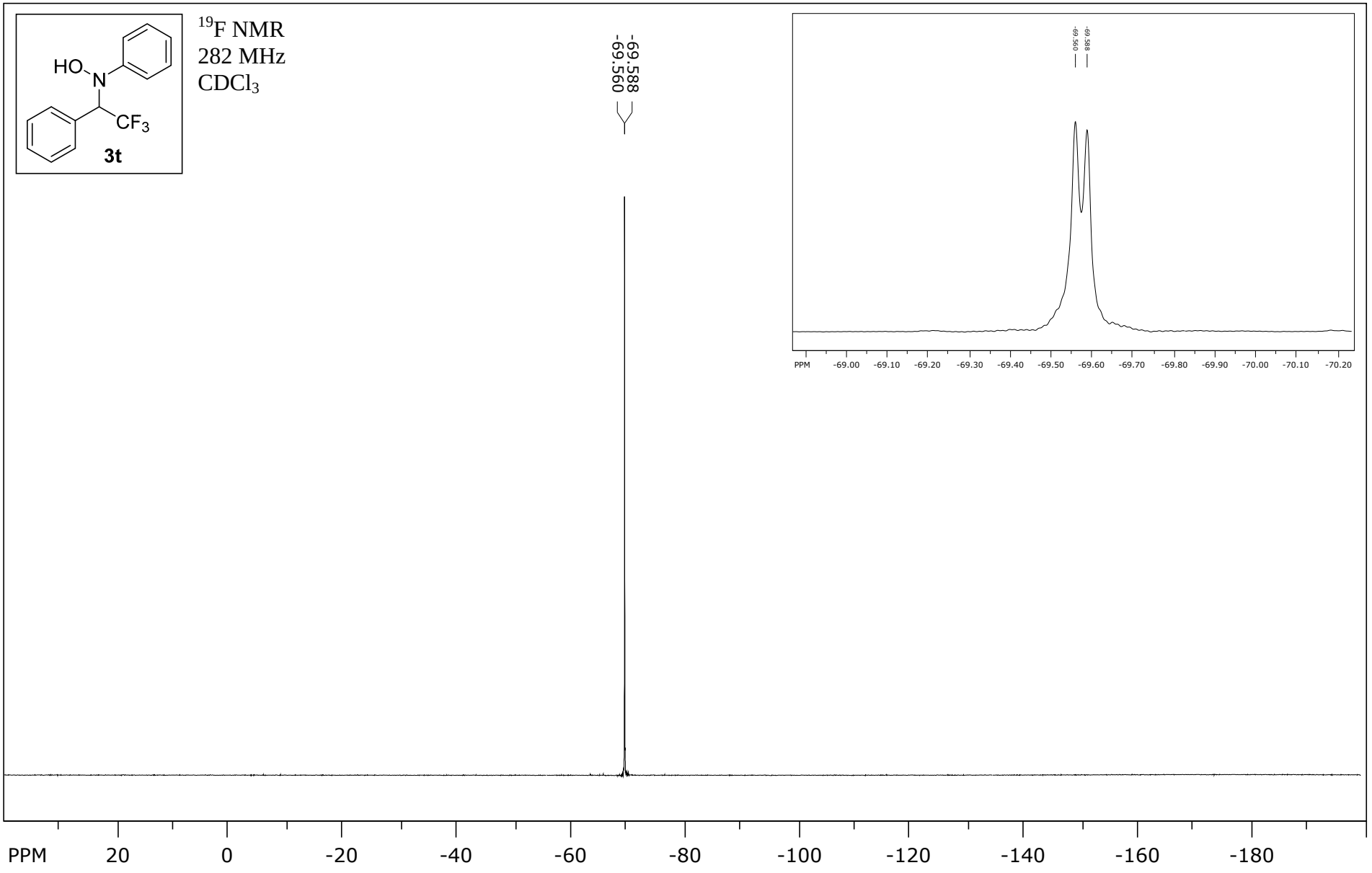


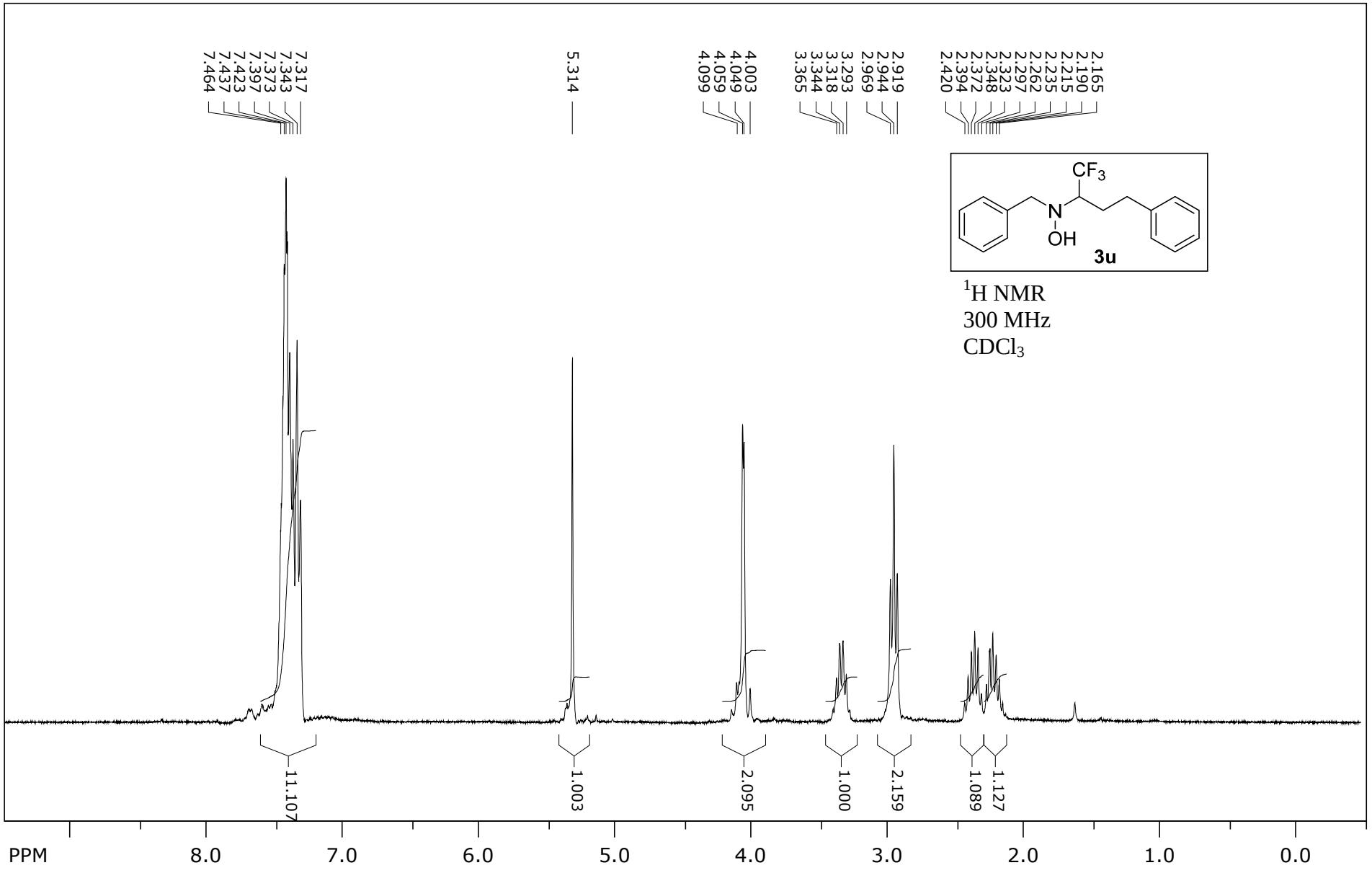
^{19}F NMR
282 MHz
$CDCl_3$

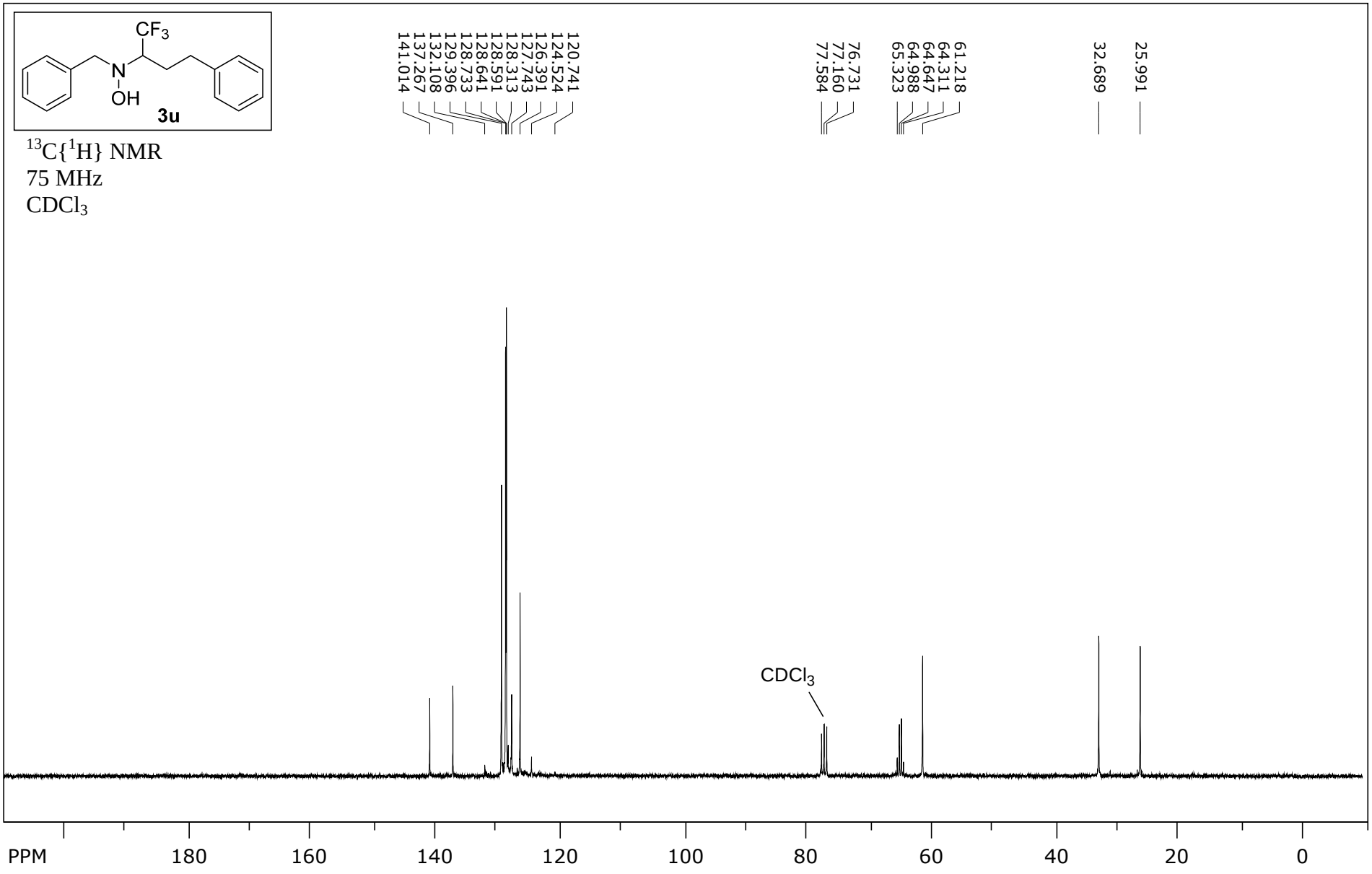

HO
N
CF3
3t
1H NMR
300 MHz
CDCl3
7.366
7.313
7.288
7.134
7.107
7.080
7.054
5.462
5.000
4.974
4.946
4.919
7.476
3.083
1.026
1.000
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0



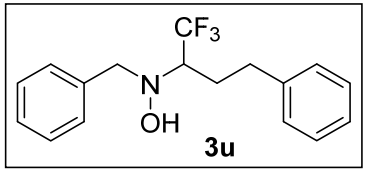
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$


HO
N
CF3
3t
19F NMR
282 MHz
CDCl3
-69.560
-69.588
PPM
-69.00
-69.10
-69.20
-69.30
-69.40
-69.50
-69.60
-69.70
-69.80
-69.90
-70.00
-70.10
-70.20
PPM
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180

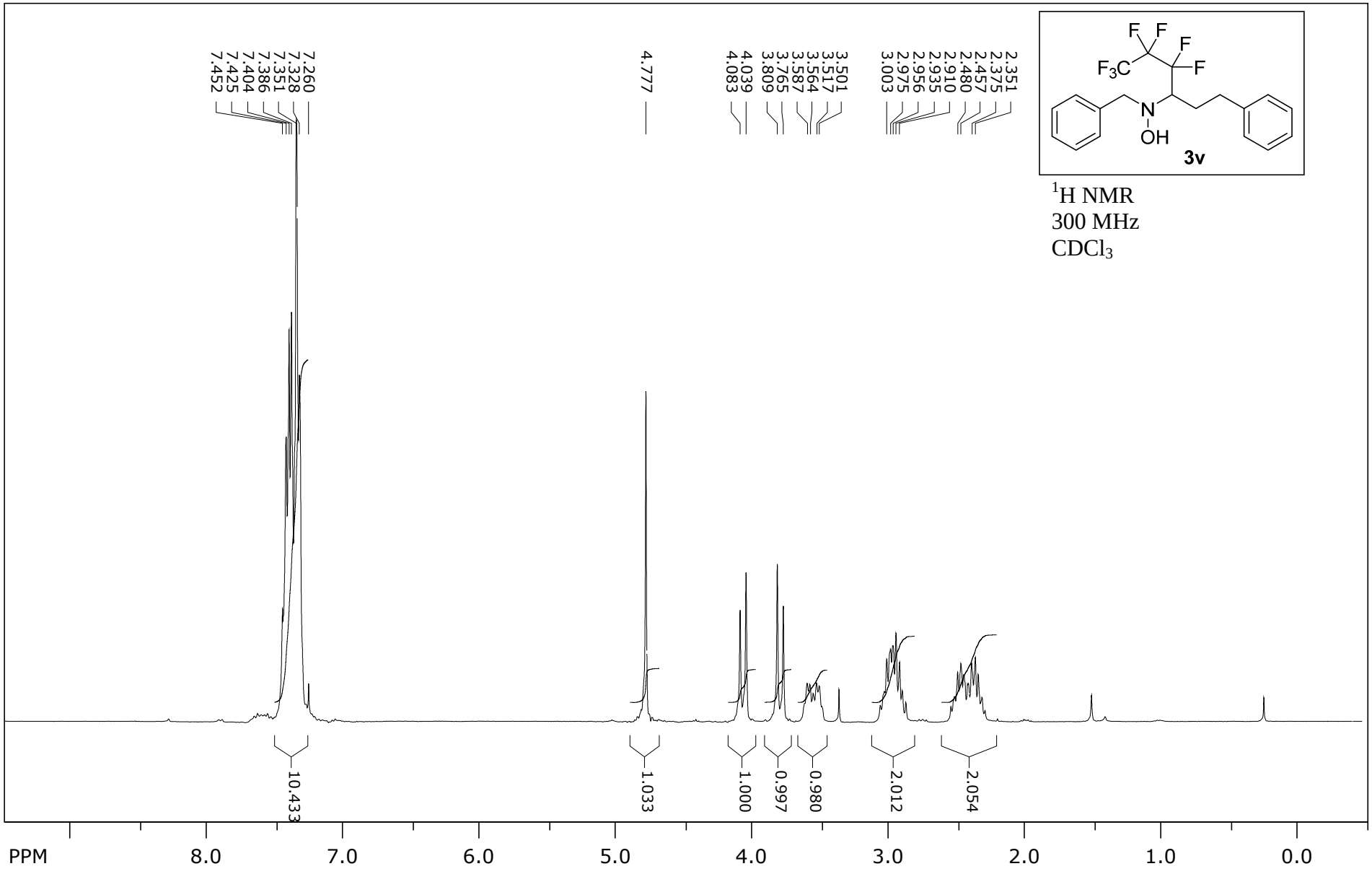

7.464
7.437
7.423
7.397
7.373
7.343
7.317
5.314
4.099
4.059
4.049
4.003
3.365
3.344
3.318
3.293
2.969
2.944
2.919
2.420
2.394
2.372
2.348
2.323
2.297
2.262
2.235
2.215
2.190
2.165
CF3
N
OH
3u
1H NMR
300 MHz
CDCl3
11.107
1.003
2.095
1.000
2.159
1.089
1.127
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

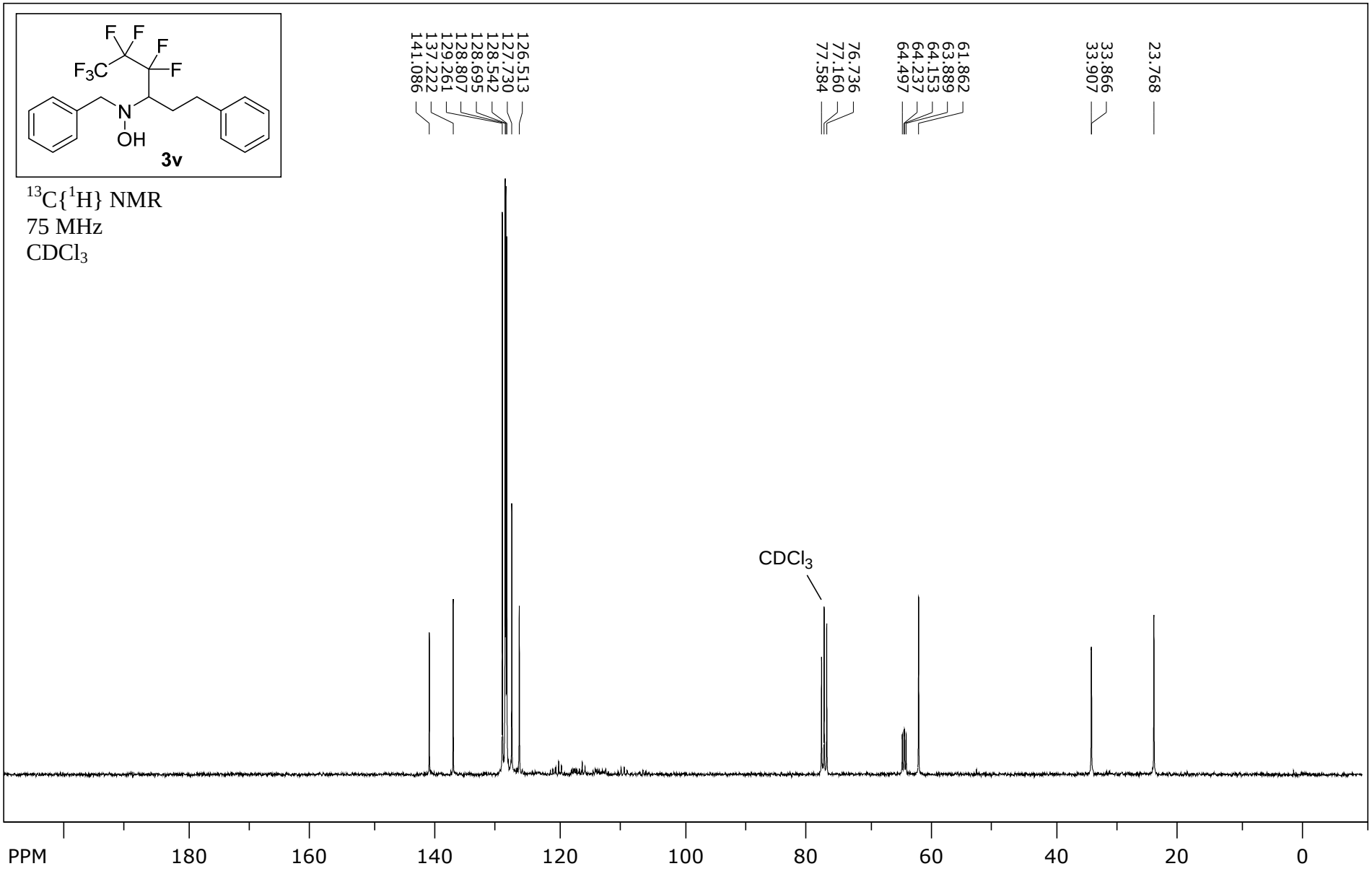


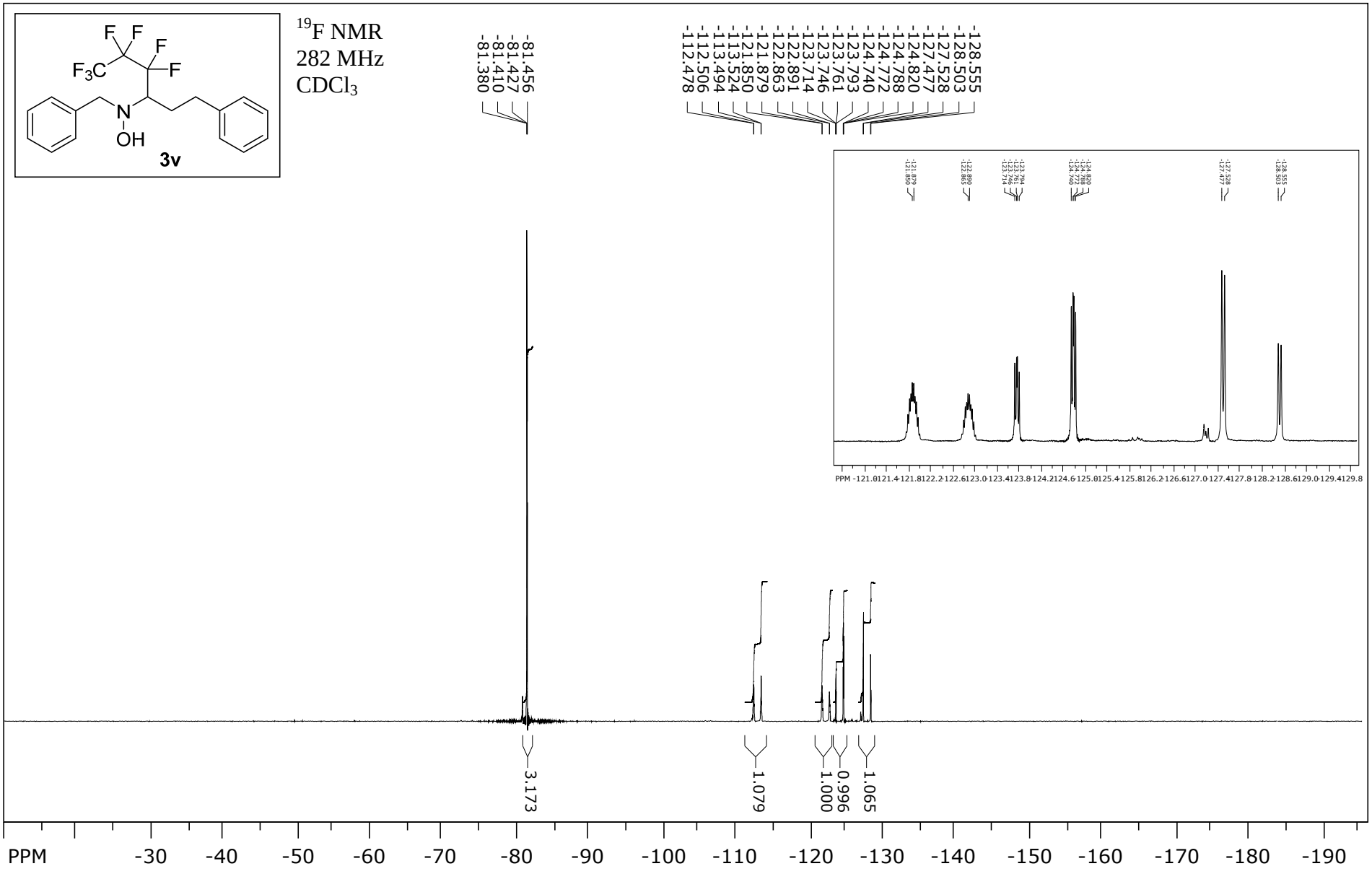
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$

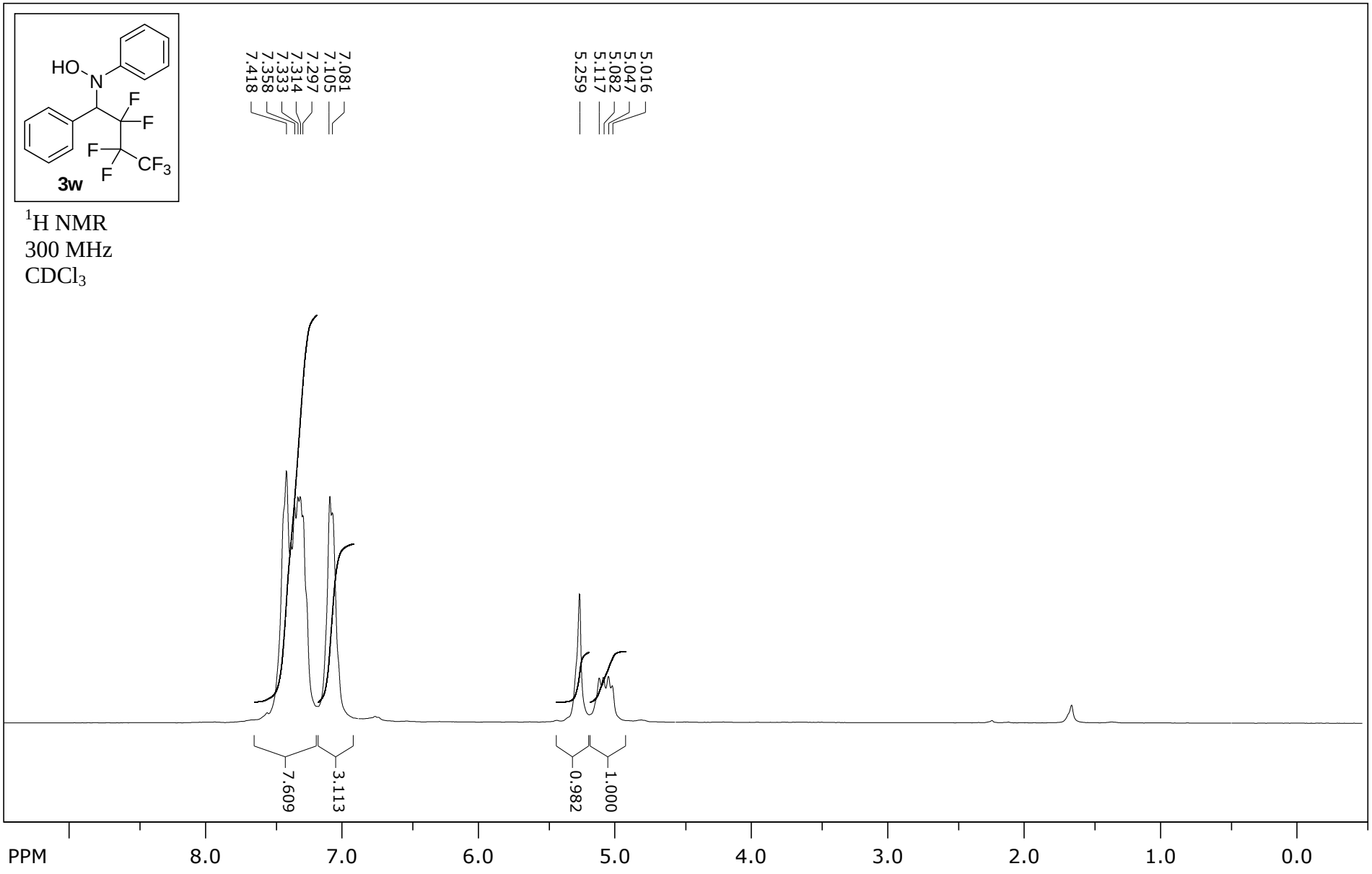


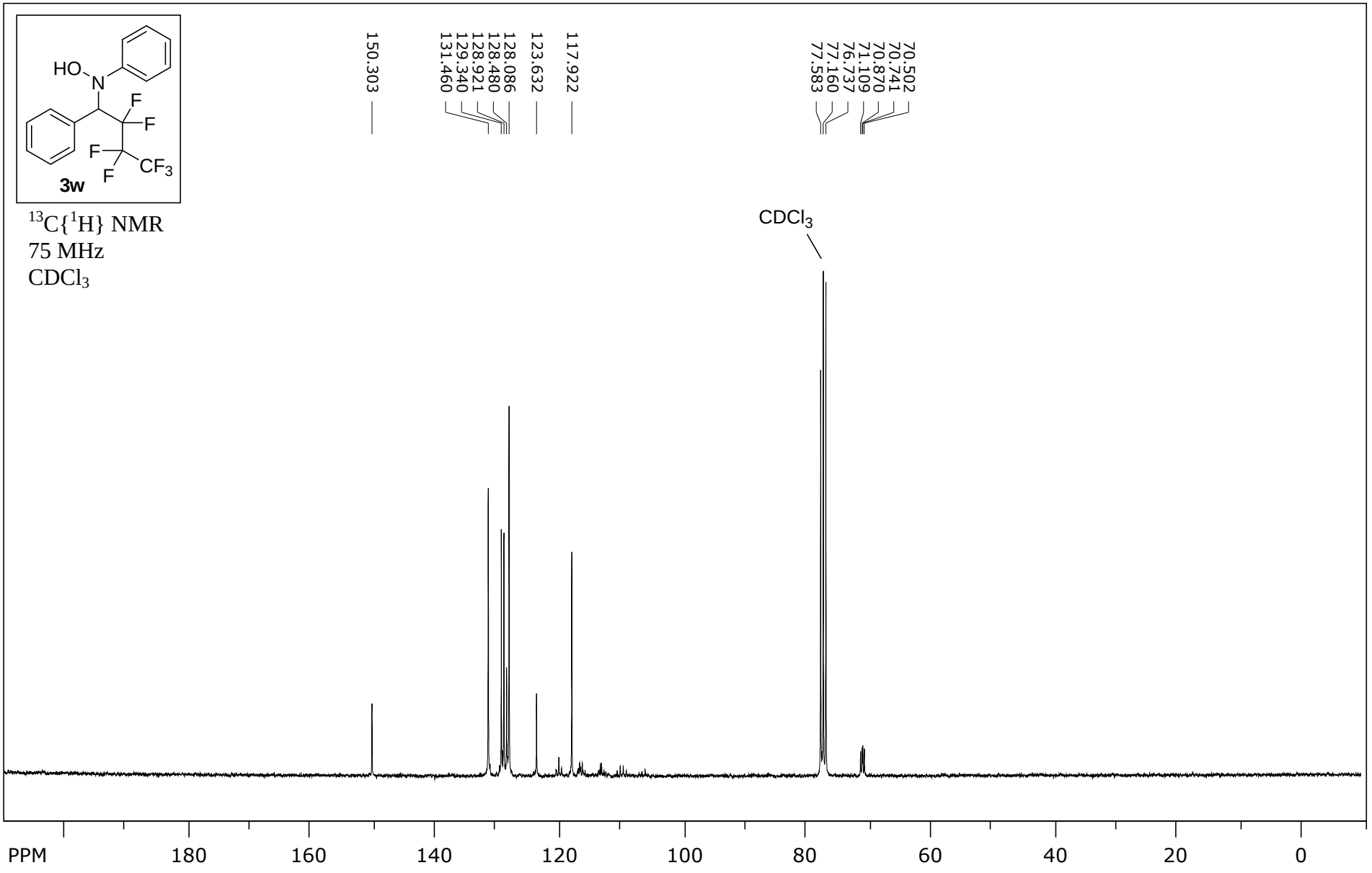
^{19}F NMR
282 MHz
$CDCl_3$


7.452
7.425
7.404
7.386
7.351
7.328
7.260
4.777
4.083
4.039
3.809
3.765
3.587
3.564
3.517
3.501
3.003
2.975
2.956
2.935
2.910
2.480
2.457
2.375
2.351
F
F
F
F3C
F
N
OH
3v
1H NMR
300 MHz
CDCl3
10.433
1.033
1.000
0.997
0.980
2.012
2.054
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

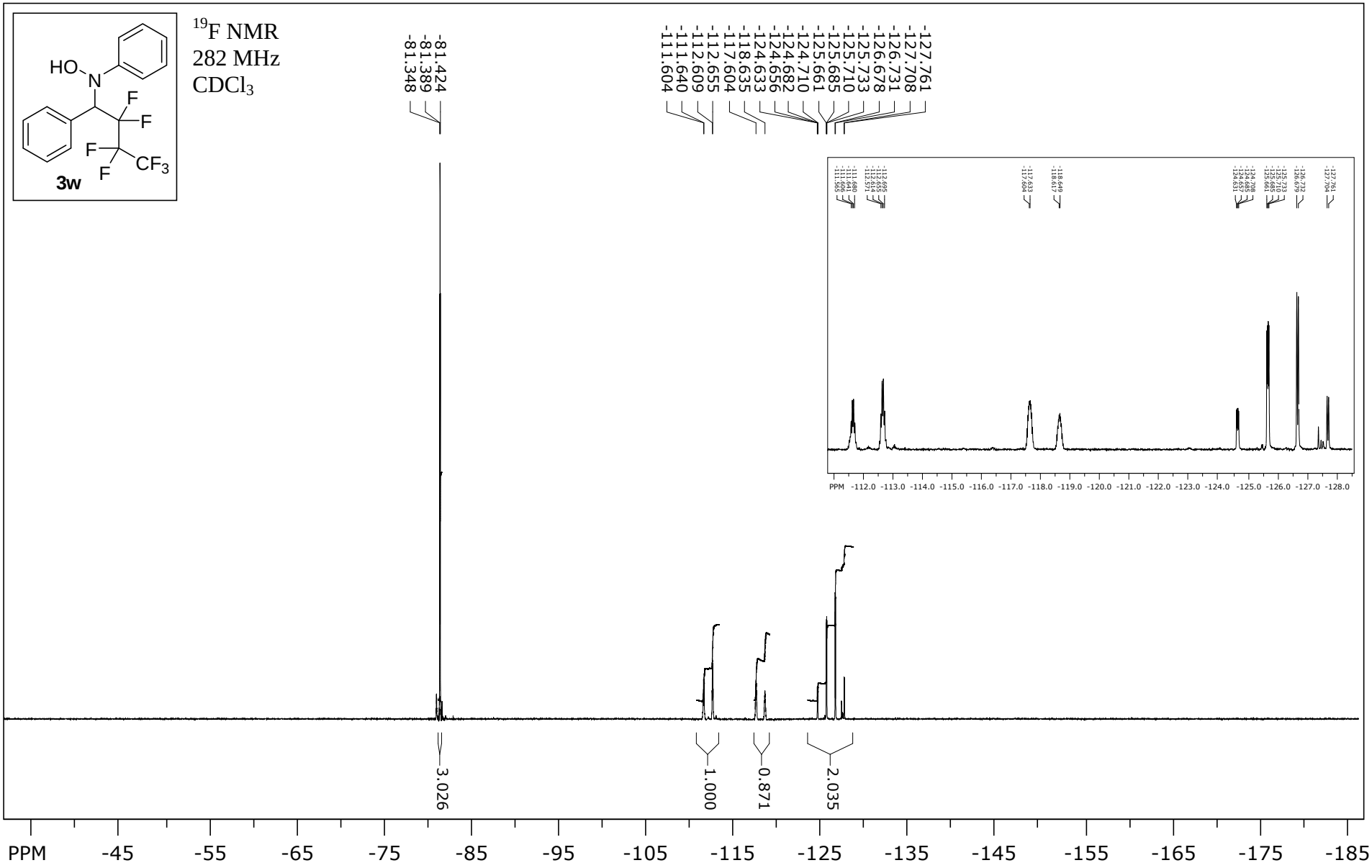

F F
F
F3C
F
N
OH
3v
141.086
137.222
129.261
128.807
128.695
128.542
127.730
126.513
77.584
77.160
76.736
64.497
64.237
64.153
63.889
61.862
33.907
33.866
23.768
13C{1H} NMR
75 MHz
CDCl3
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0

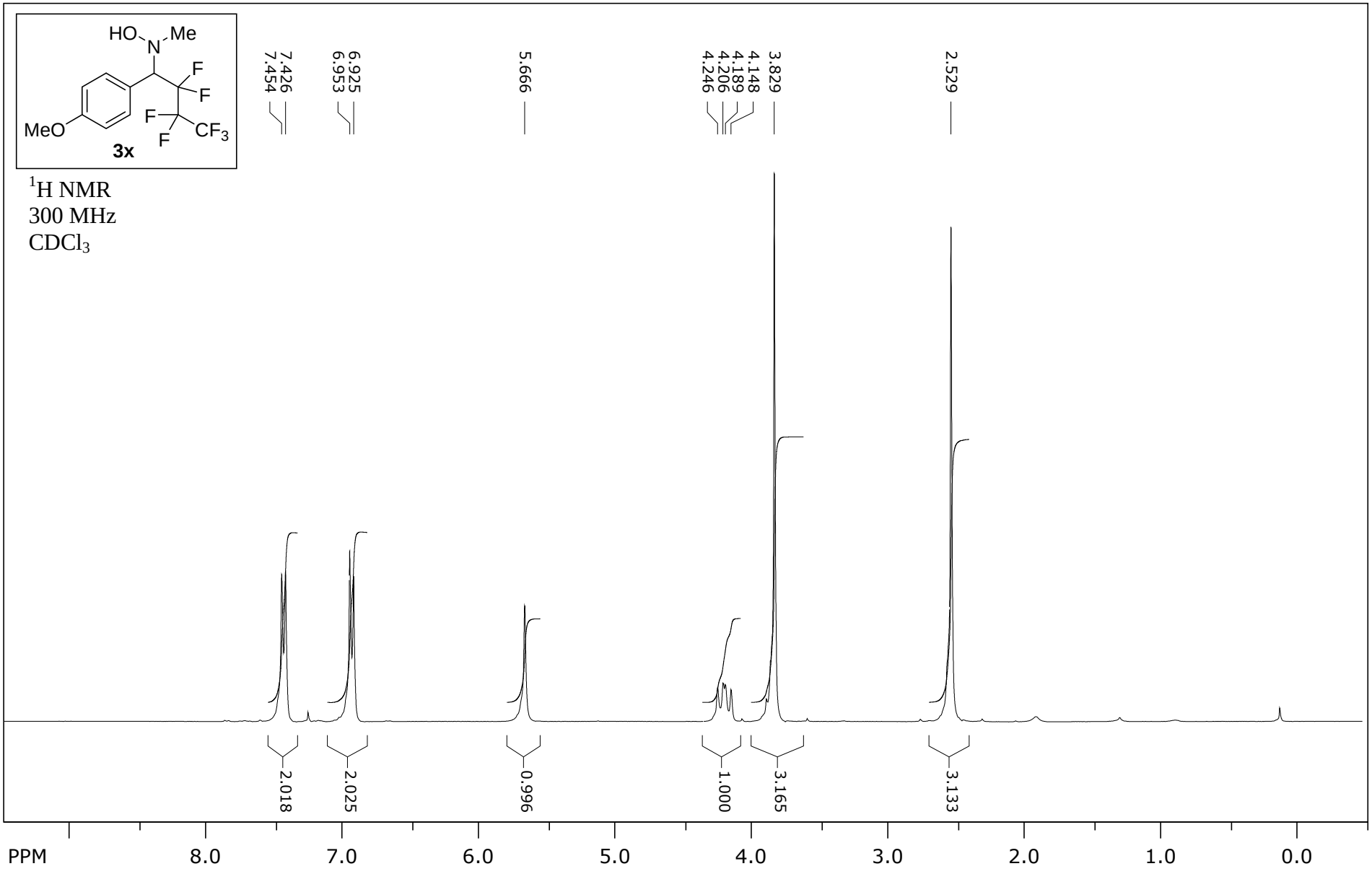

3v
^{19}F NMR
282 MHz
$CDCl_3$
-81.380
-81.410
-81.427
-81.456
-112.478
-112.506
-113.494
-113.524
-121.850
-121.879
-122.863
-122.891
-123.714
-123.746
-123.761
-123.793
-124.740
-124.772
-124.788
-124.820
-127.477
-127.528
-128.503
-128.555
3.173
1.079
1.000
0.996
1.065
PPM
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190

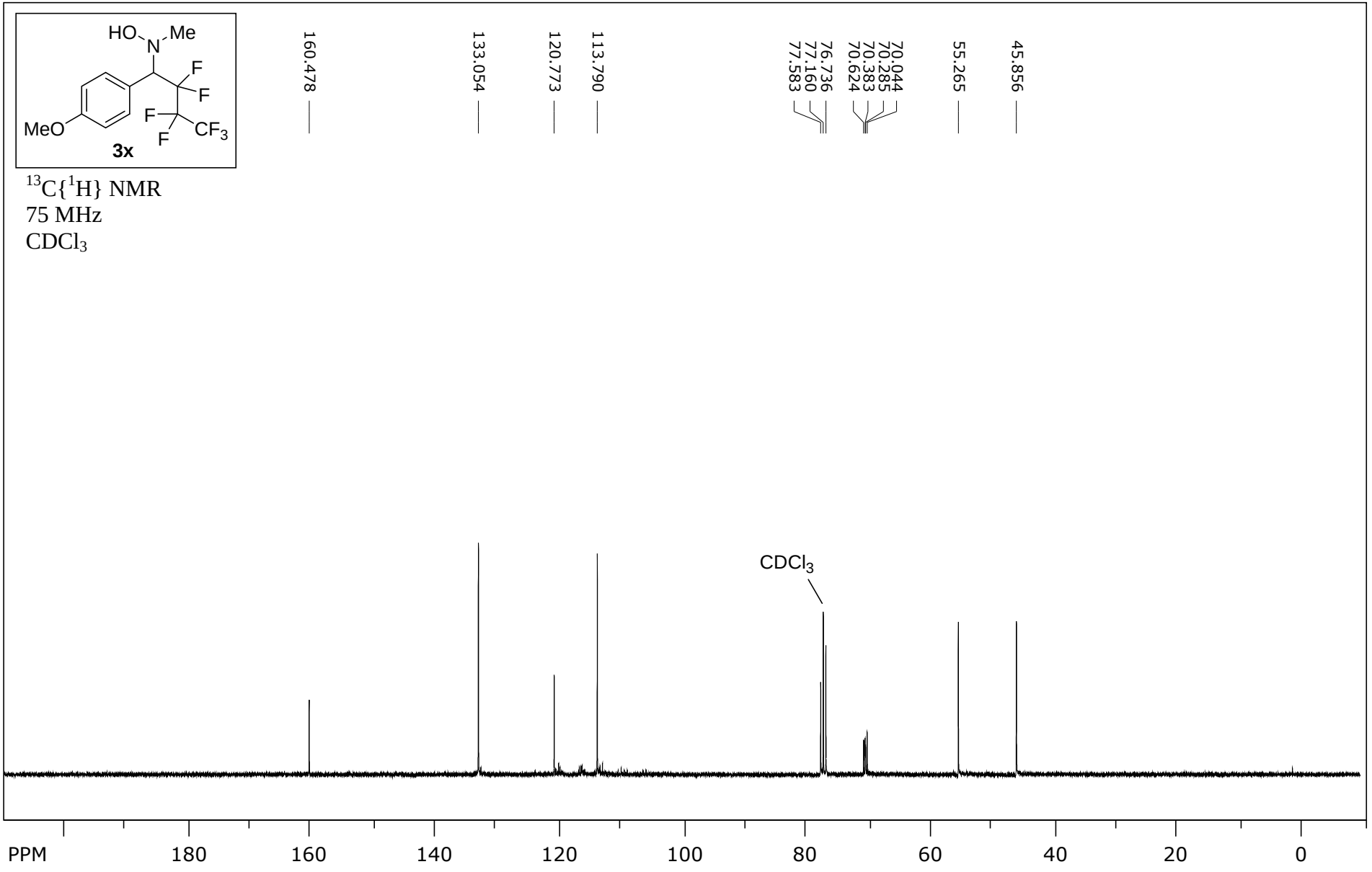

HO
N
F
F
F
F
CF3
3w
7.418
7.358
7.333
7.314
7.297
7.105
7.081
5.259
5.117
5.082
5.047
5.016
1H NMR
300 MHz
CDCl3
7.609
3.113
0.982
1.000
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0



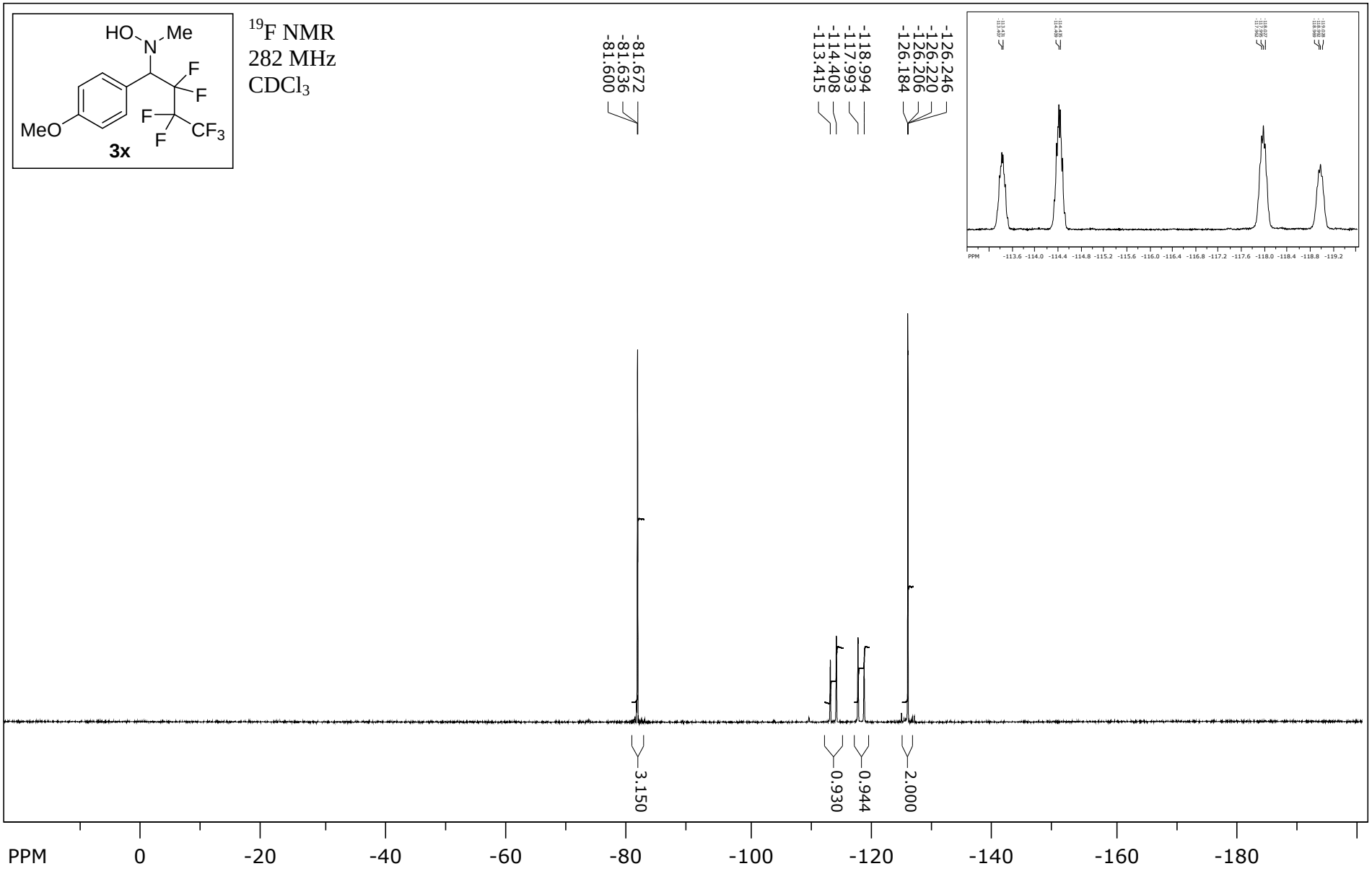
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$

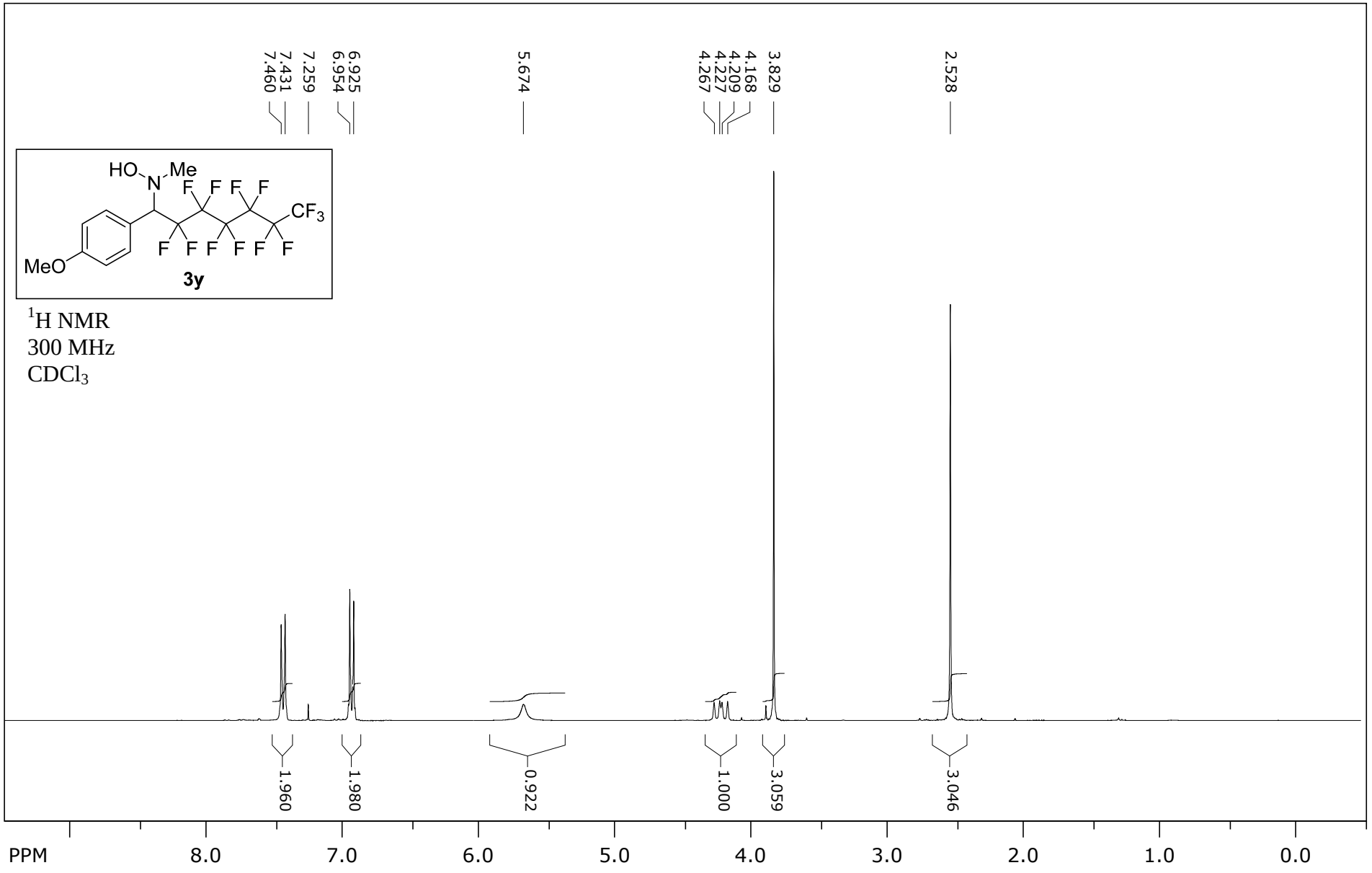

HO
N
F
F
F
F
CF3
3w
19F NMR
282 MHz
CDCl3
-81.348
-81.389
-81.424
-111.604
-111.640
-112.609
-112.655
-117.604
-118.635
-124.633
-124.656
-124.682
-124.710
-125.661
-125.685
-125.710
-125.733
-126.678
-126.731
-127.708
-127.761
3.026
1.000
0.871
2.035
PPM -45 -55 -65 -75 -85 -95 -105 -115 -125 -135 -145 -155 -165 -175 -185
PPM -112.0 -113.0 -114.0 -115.0 -116.0 -117.0 -118.0 -119.0 -120.0 -121.0 -122.0 -123.0 -124.0 -125.0 -126.0 -127.0 -128.0

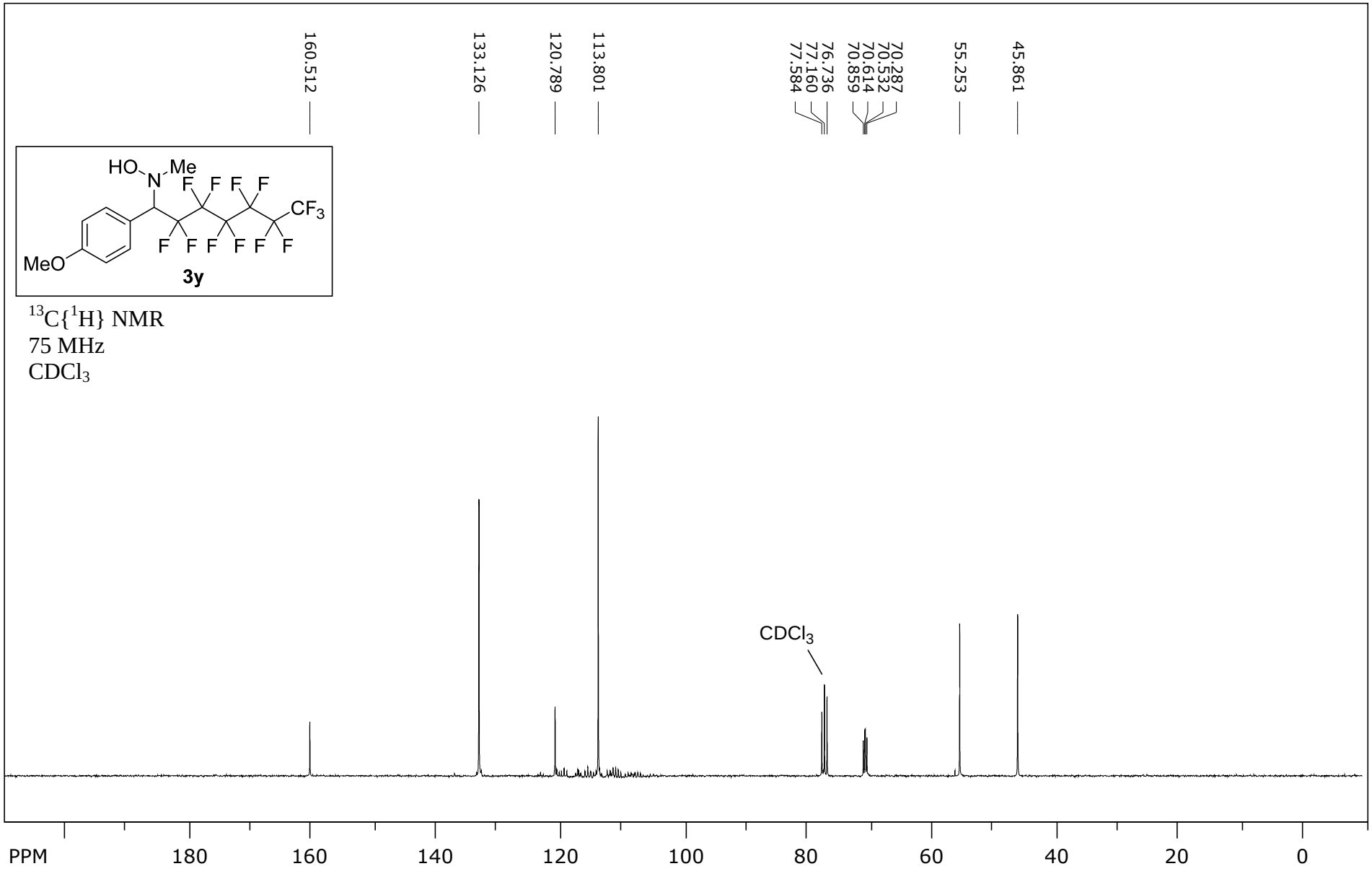

HO
N
Me
F
F
F
F
CF3
MeO
3x
1H NMR
300 MHz
CDCl3
7.426
7.454
6.925
6.953
5.666
4.246
4.206
4.189
4.148
3.829
2.529
2.018
2.025
0.996
1.000
3.165
3.133
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

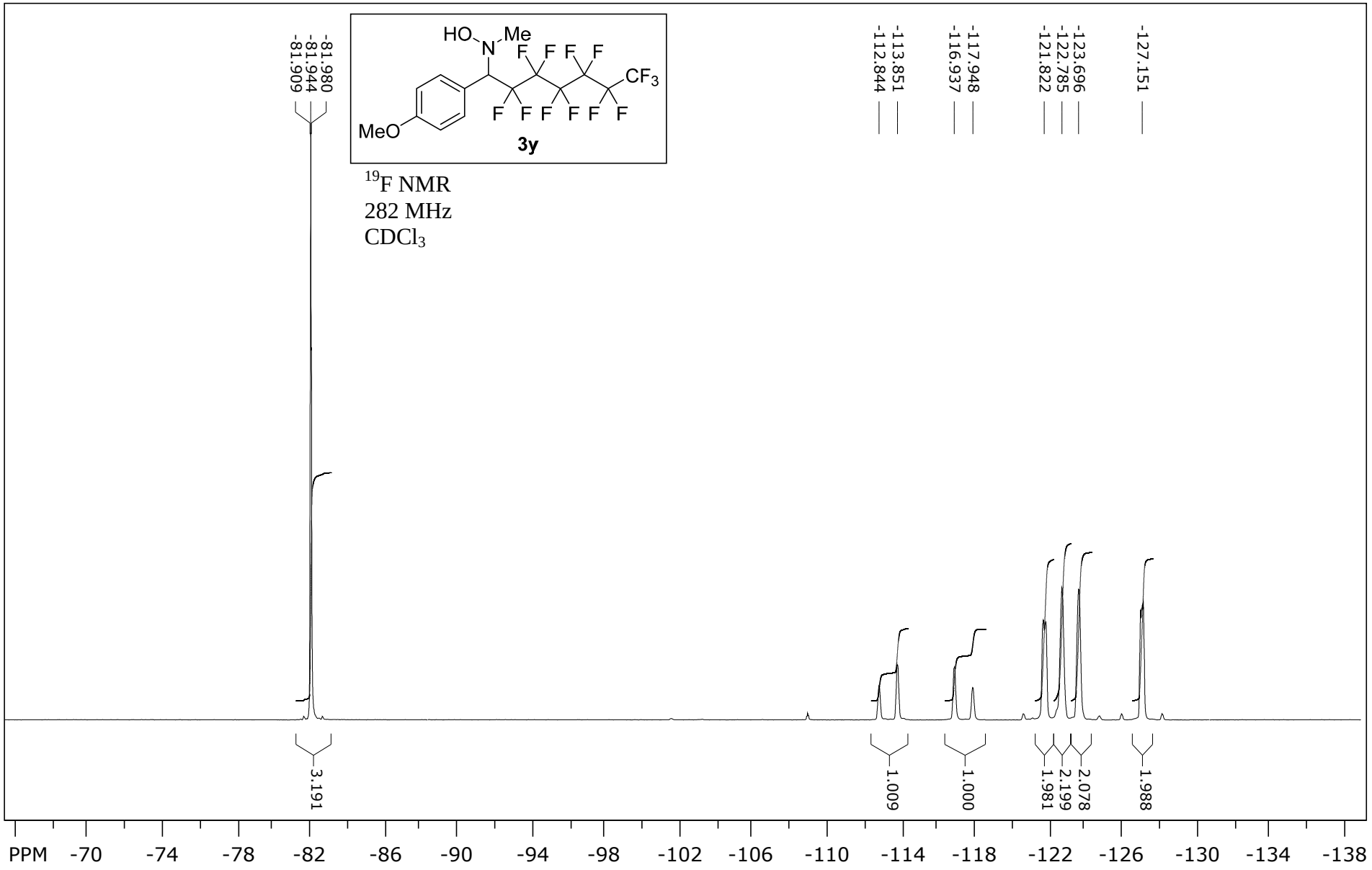


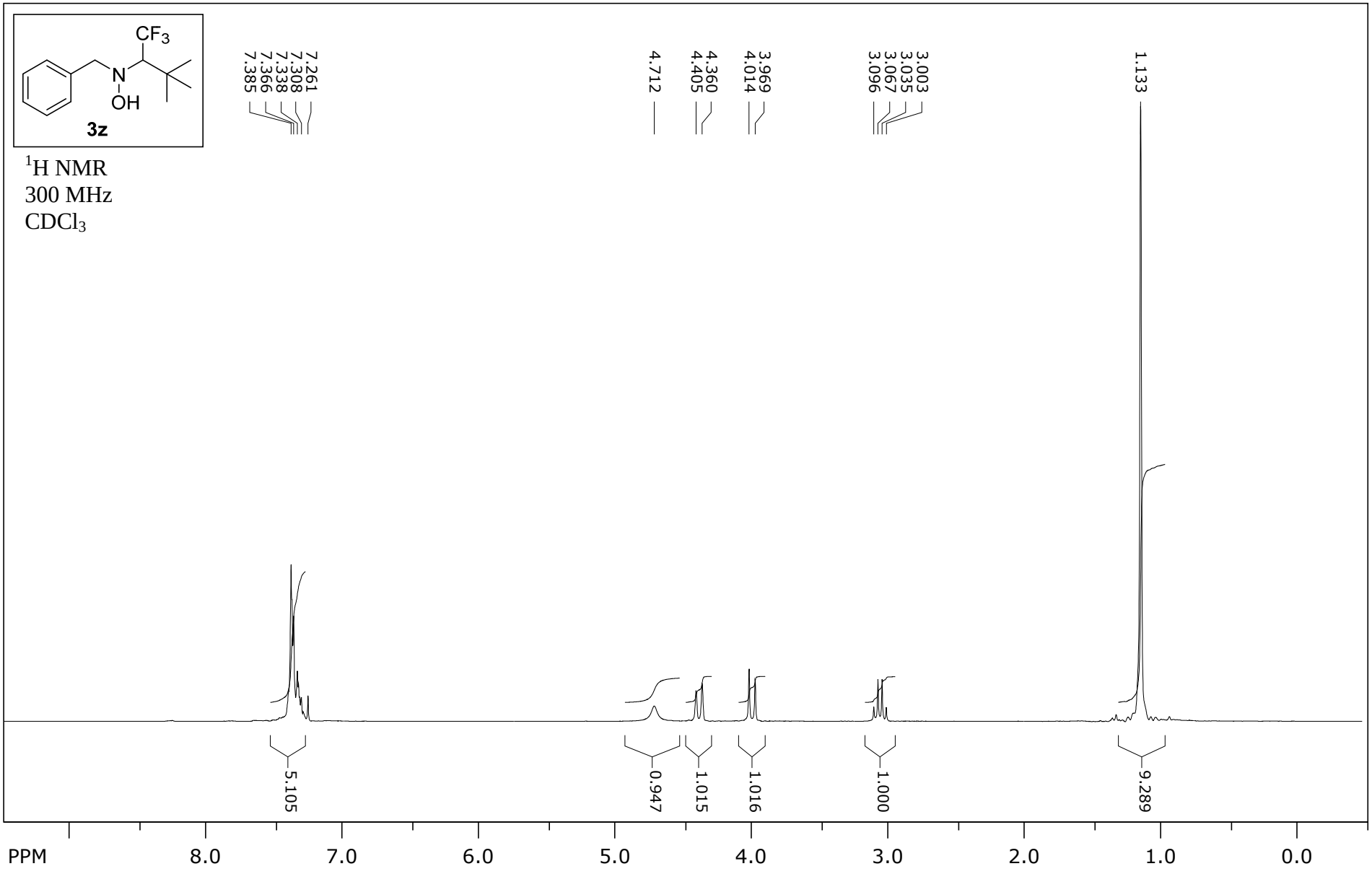
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$


HO
N
Me
F
F
F
F
CF3
MeO
3x
19F NMR
282 MHz
CDCl3
-81.672
-81.636
-81.600
-113.415
-114.408
-117.993
-118.994
-126.184
-126.206
-126.220
-126.246
3.150
0.930
0.944
2.000
PPM
0
-20
-40
-60
-80
-100
-120
-140
-160
-180

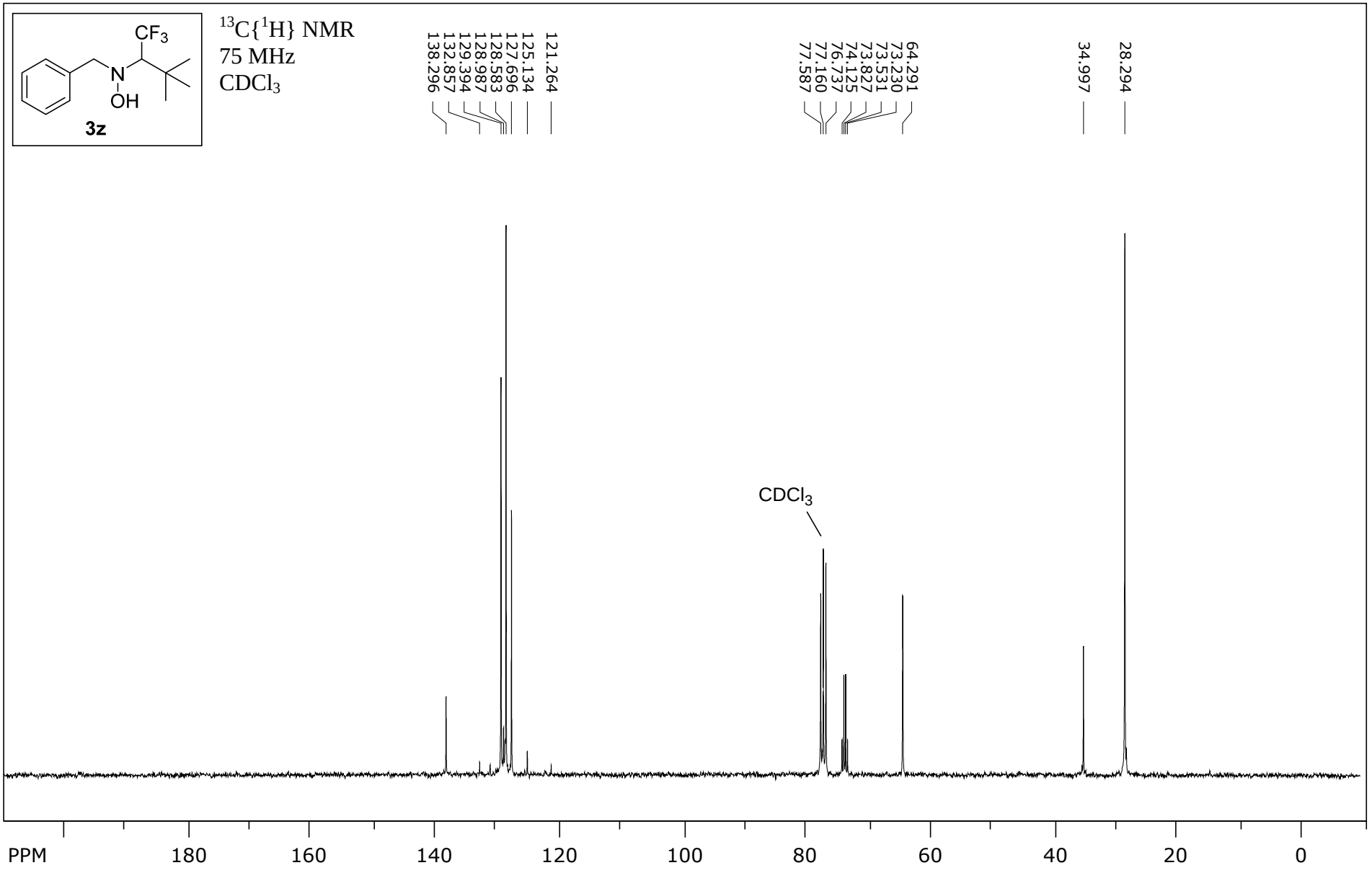

7.460
7.431
7.259
6.954
6.925
5.674
4.267
4.227
4.209
4.168
3.829
2.528
HO
N
Me
F
F
F
F
CF3
F
F
F
F
F
F
MeO
3y
1H NMR
300 MHz
CDCl3
1.960
1.980
0.922
1.000
3.059
3.046
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

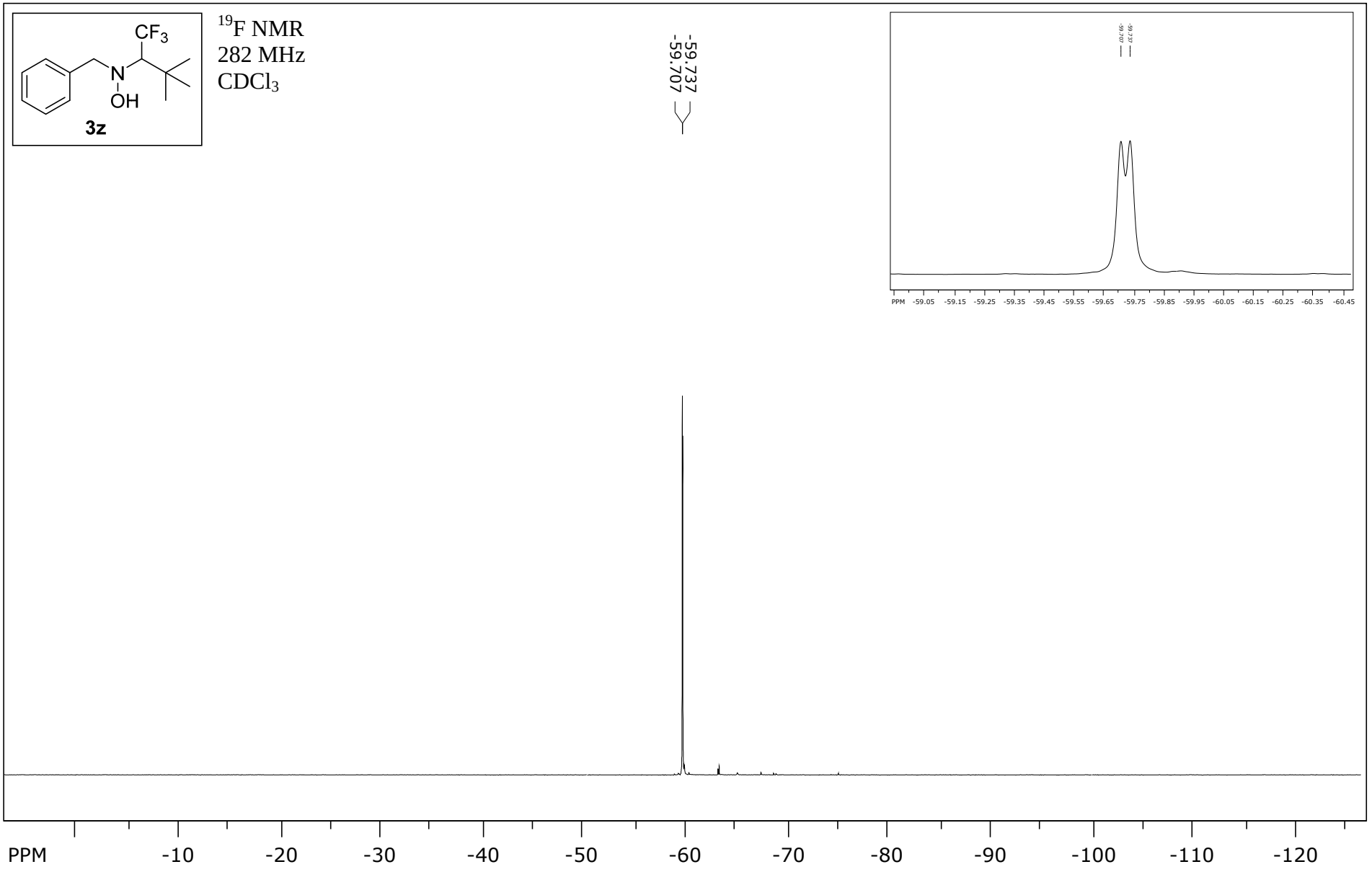

160.512
133.126
120.789
113.801
77.584
77.160
76.736
70.859
70.614
70.532
70.287
55.253
45.861
HO
N
Me
F
CF3
MeO
3y
13C{1H} NMR
75 MHz
CDCl3
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0

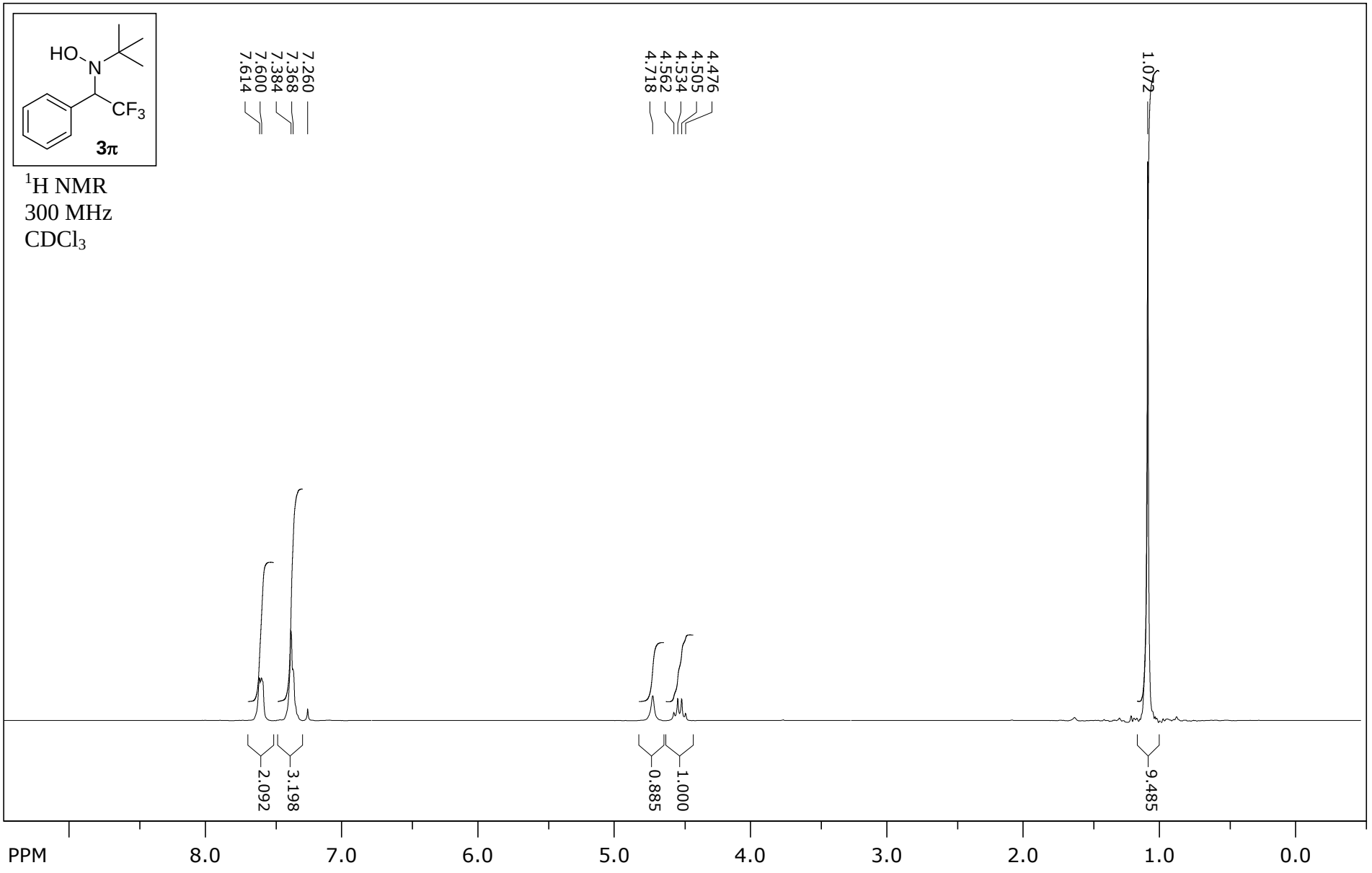

HO
N
Me
F F F F
CF3
F F F F F F
MeO
3y
-81.909
-81.944
-81.980
-112.844
-113.851
-116.937
-117.948
-121.822
-122.785
-123.696
-127.151
19F NMR
282 MHz
CDCl3
3.191
1.009
1.000
1.981
2.199
2.078
1.988
PPM -70 -74 -78 -82 -86 -90 -94 -98 -102 -106 -110 -114 -118 -122 -126 -130 -134 -138

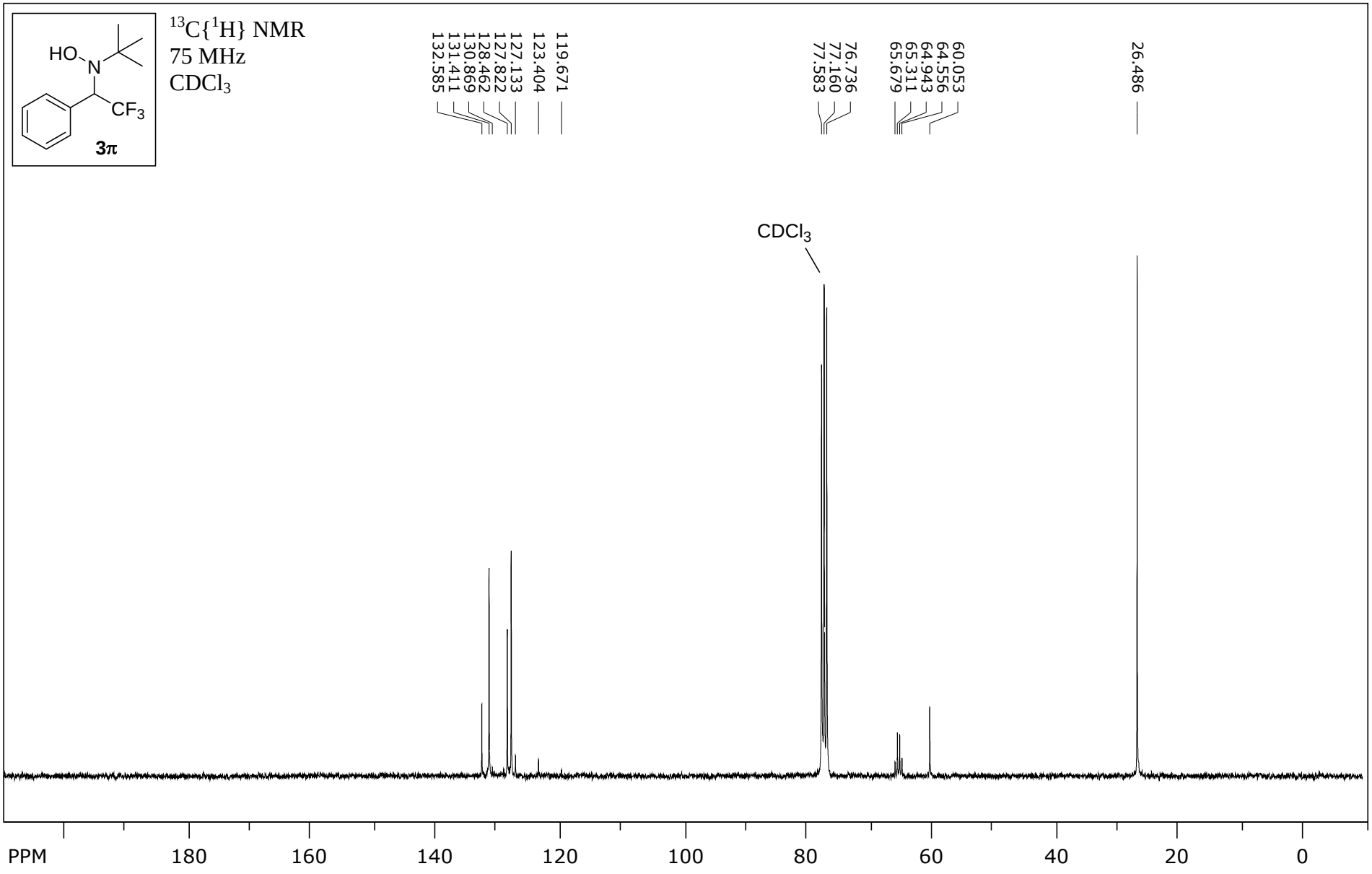


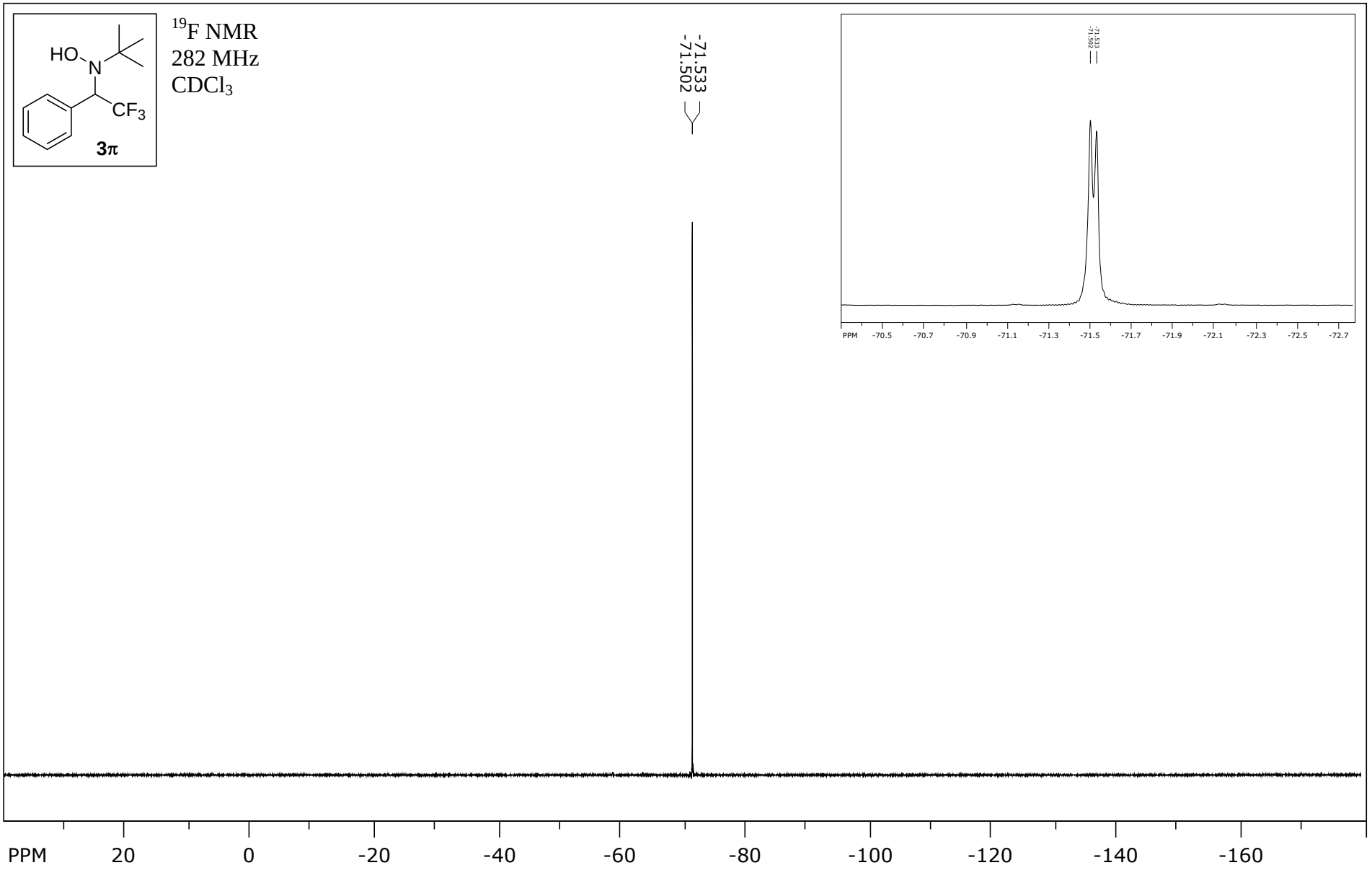
^{1}H NMR
300 MHz
$CDCl_3$

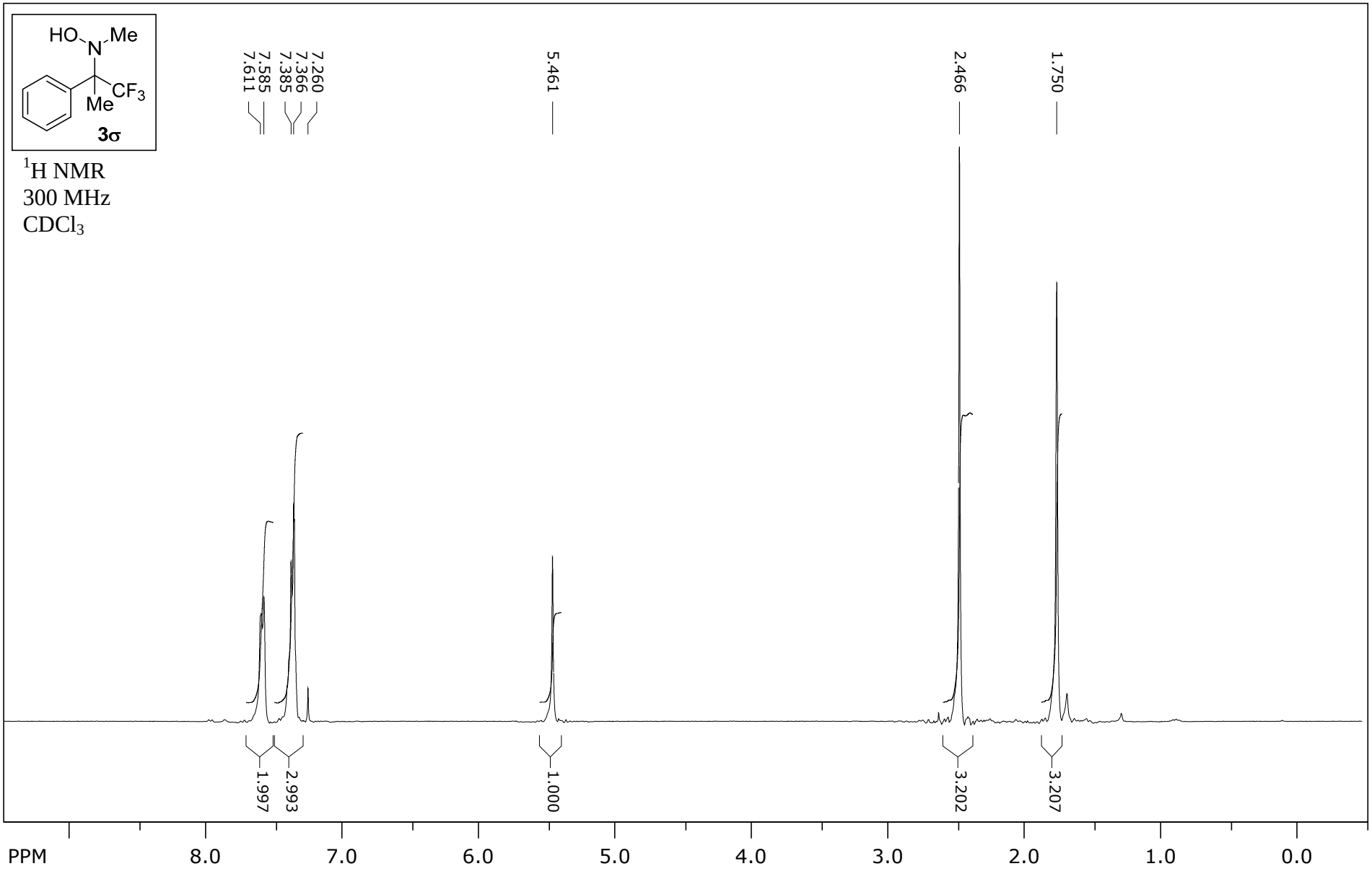

CF3
N
OH
3z
13C{1H} NMR
75 MHz
CDCl3
138.296
132.857
129.394
128.987
128.583
127.696
125.134
121.264
77.587
77.160
76.737
74.125
73.827
73.531
73.230
64.291
34.997
28.294
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0

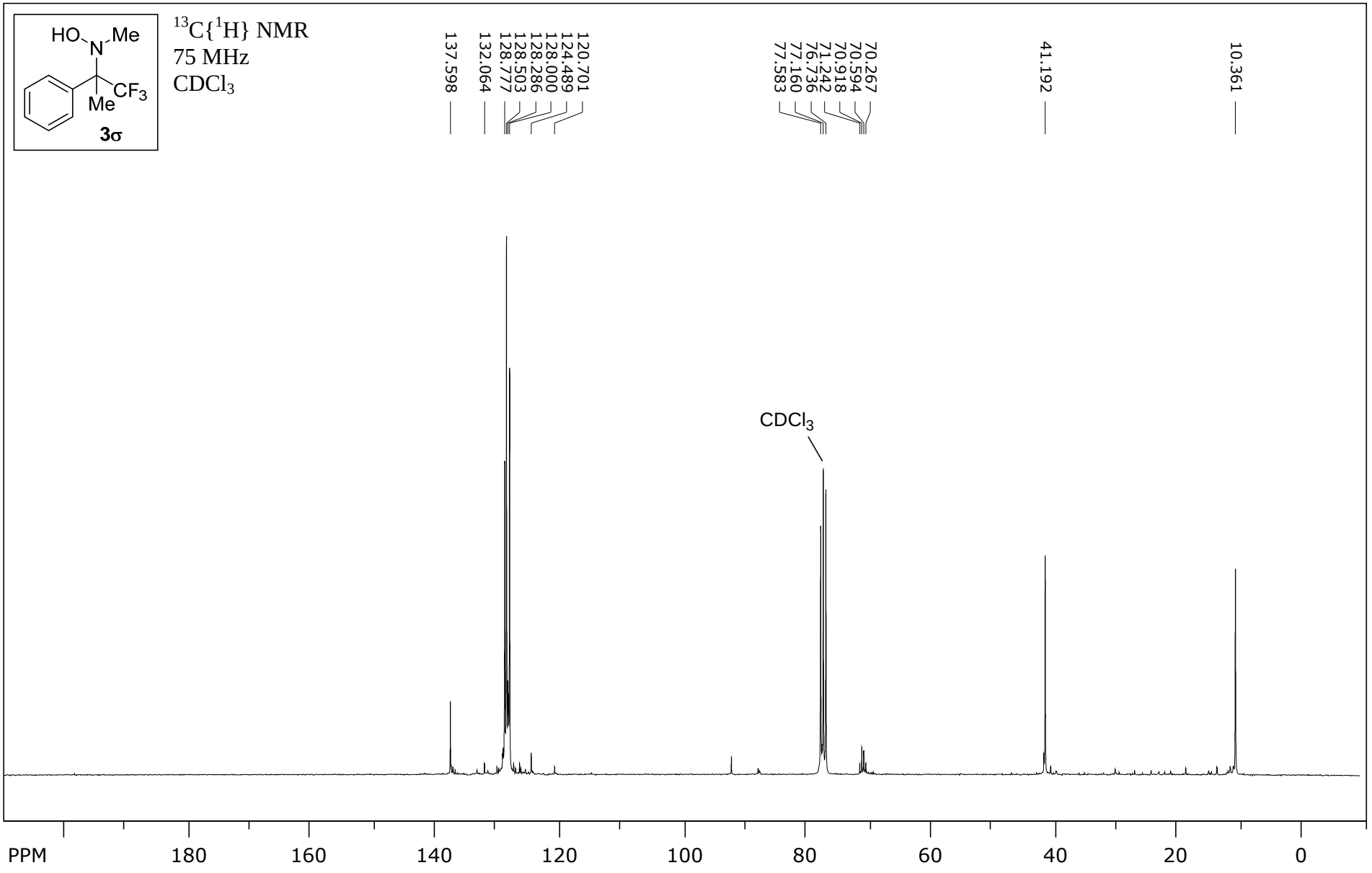

CF3
N
OH
3z
19F NMR
282 MHz
CDCl3
-59.737
-59.707
PPM -59.05 -59.15 -59.25 -59.35 -59.45 -59.55 -59.65 -59.75 -59.85 -59.95 -60.05 -60.15 -60.25 -60.35 -60.45
PPM -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120

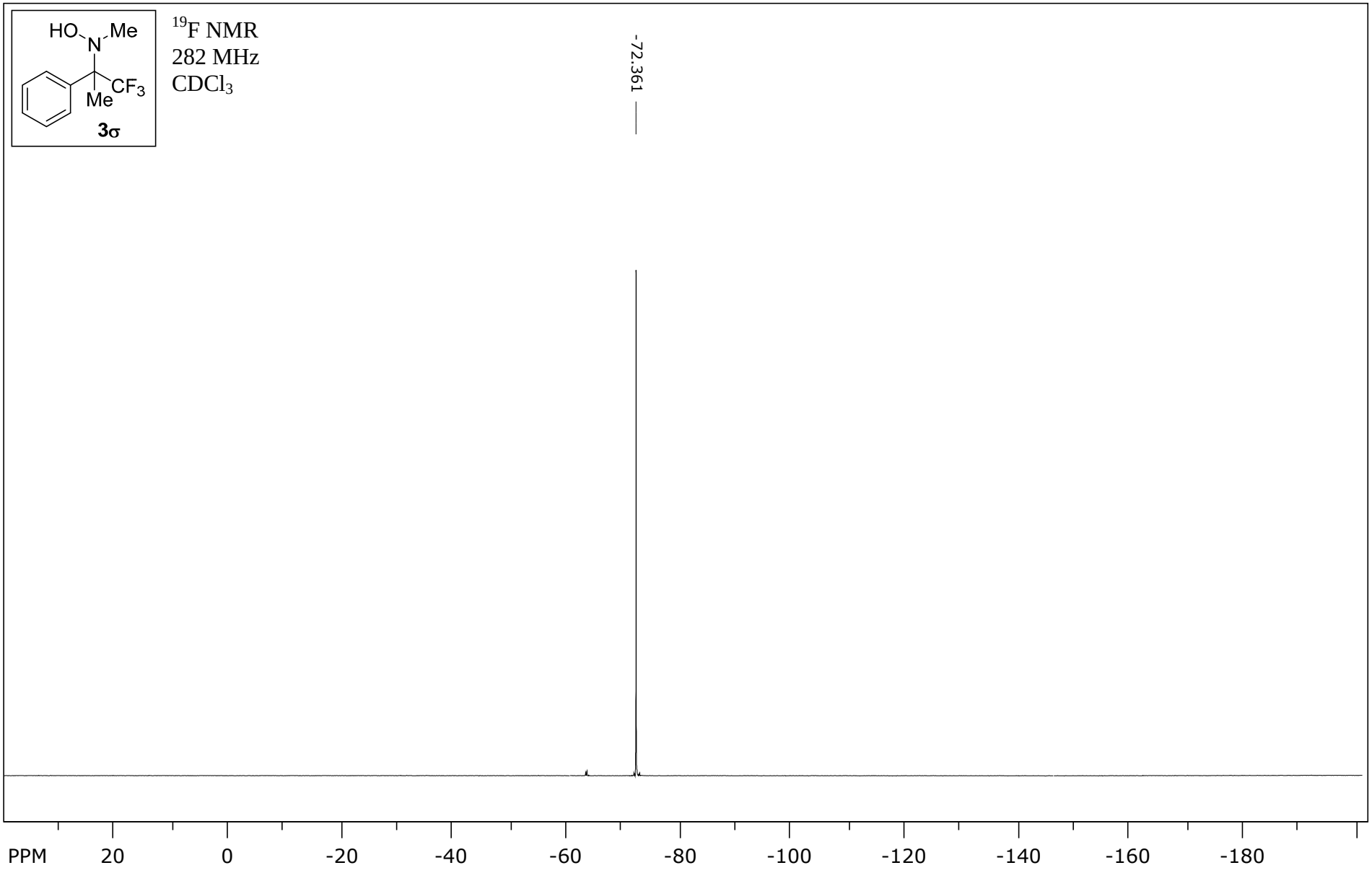

HO
N
CF3
3π
1H NMR
300 MHz
CDCl3
7.614
7.600
7.384
7.368
7.260
4.718
4.562
4.534
4.505
4.476
1.072
2.092
3.198
0.885
1.000
9.485
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

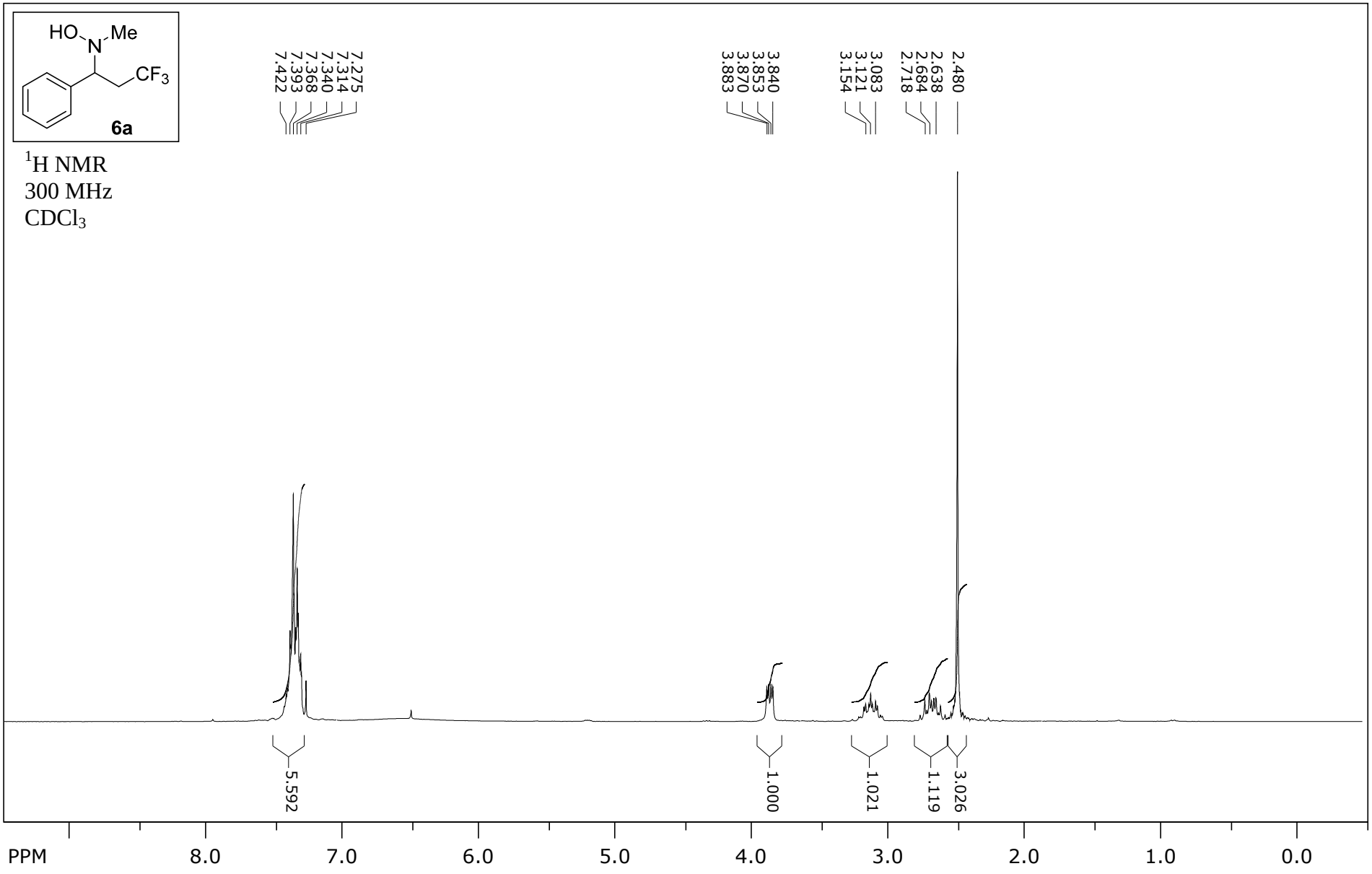

HO
N
CF3
3π
13C{1H} NMR
75 MHz
CDCl3
132.585
131.411
130.869
128.462
127.822
127.133
123.404
119.671
77.583
77.160
76.736
65.679
65.311
64.943
64.556
60.053
26.486
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0


HO
N
CF3
3π
19F NMR
282 MHz
CDCl3
-71.533
-71.502
PPM
20
0
-20
-40
-60
-80
-100
-120
-140
-160
PPM
-70.5
-70.7
-70.9
-71.1
-71.3
-71.5
-71.7
-71.9
-72.1
-72.3
-72.5
-72.7

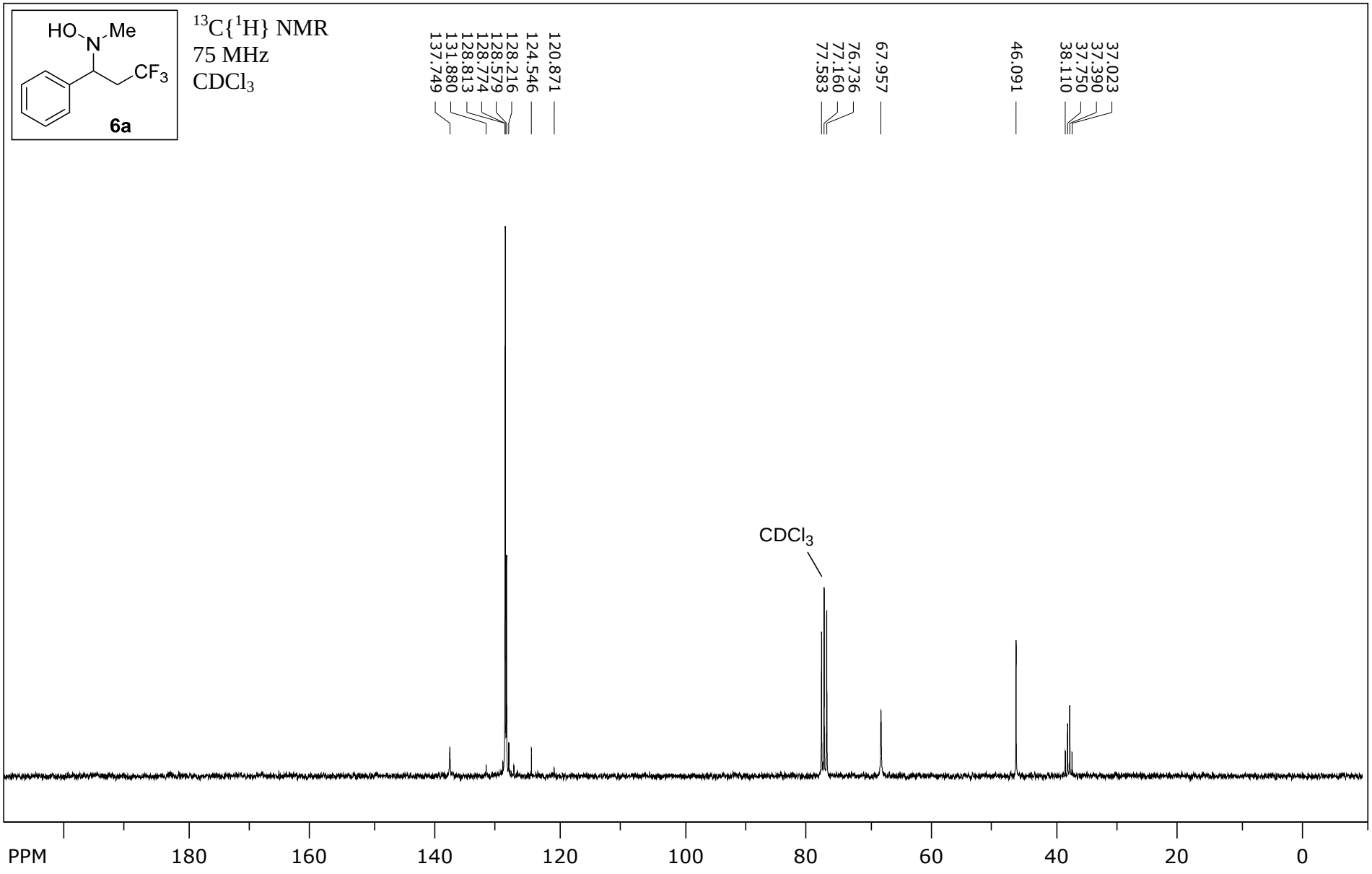

HO
N
Me
Me
CF3
3σ
1H NMR
300 MHz
CDCl3
7.611
7.585
7.385
7.366
7.260
5.461
2.466
1.750
1.997
2.993
1.000
3.202
3.207
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

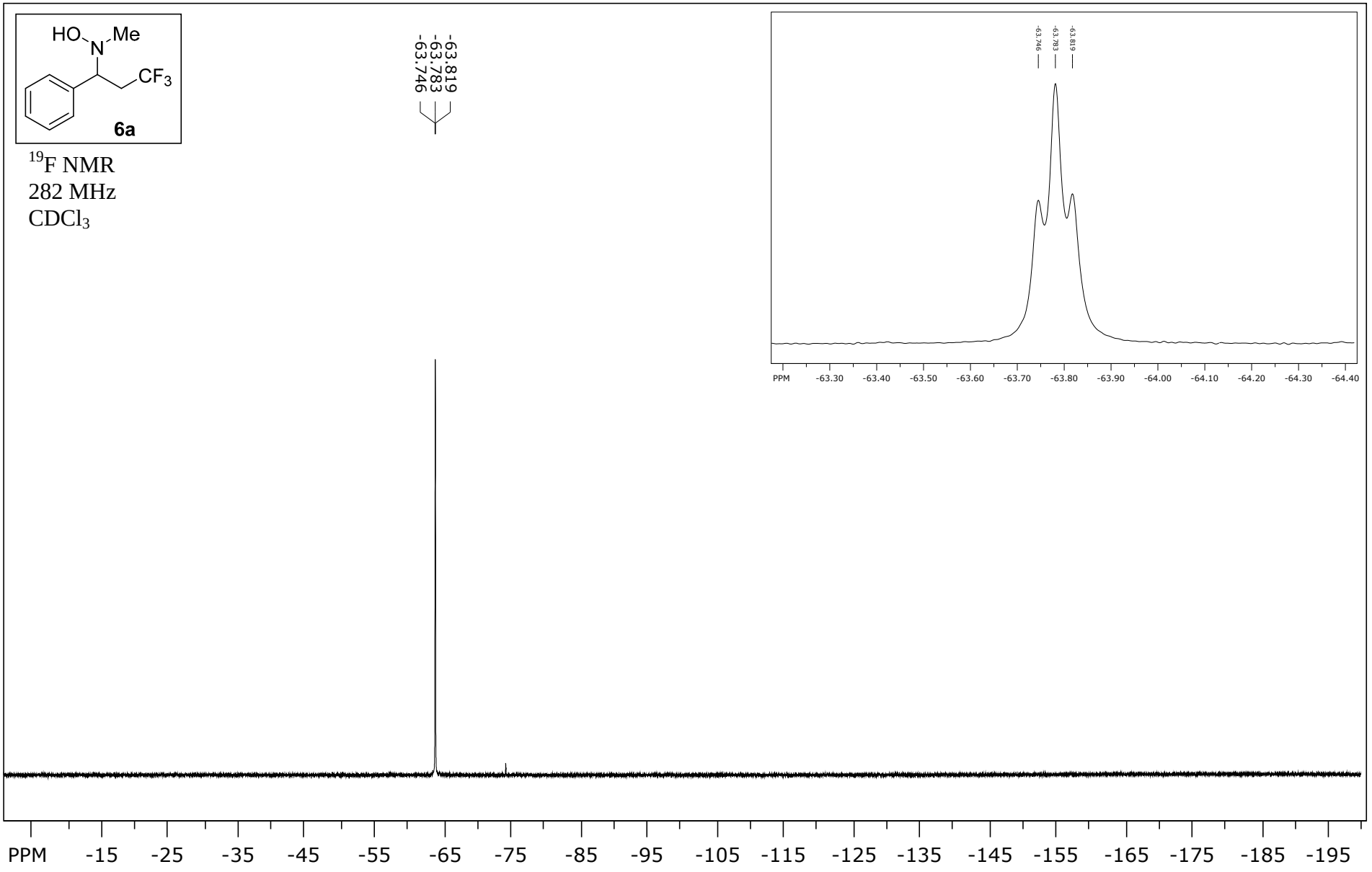

HO
N
Me
Me
CF3
3σ
13C{1H} NMR
75 MHz
CDCl3
137.598
132.064
128.777
128.503
128.286
128.000
124.489
120.701
77.583
77.160
76.736
71.242
70.918
70.594
70.267
41.192
10.361
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0


HO
N
Me
CF3
Me
3σ
19F NMR
282 MHz
CDCl3
-72.361
PPM
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180

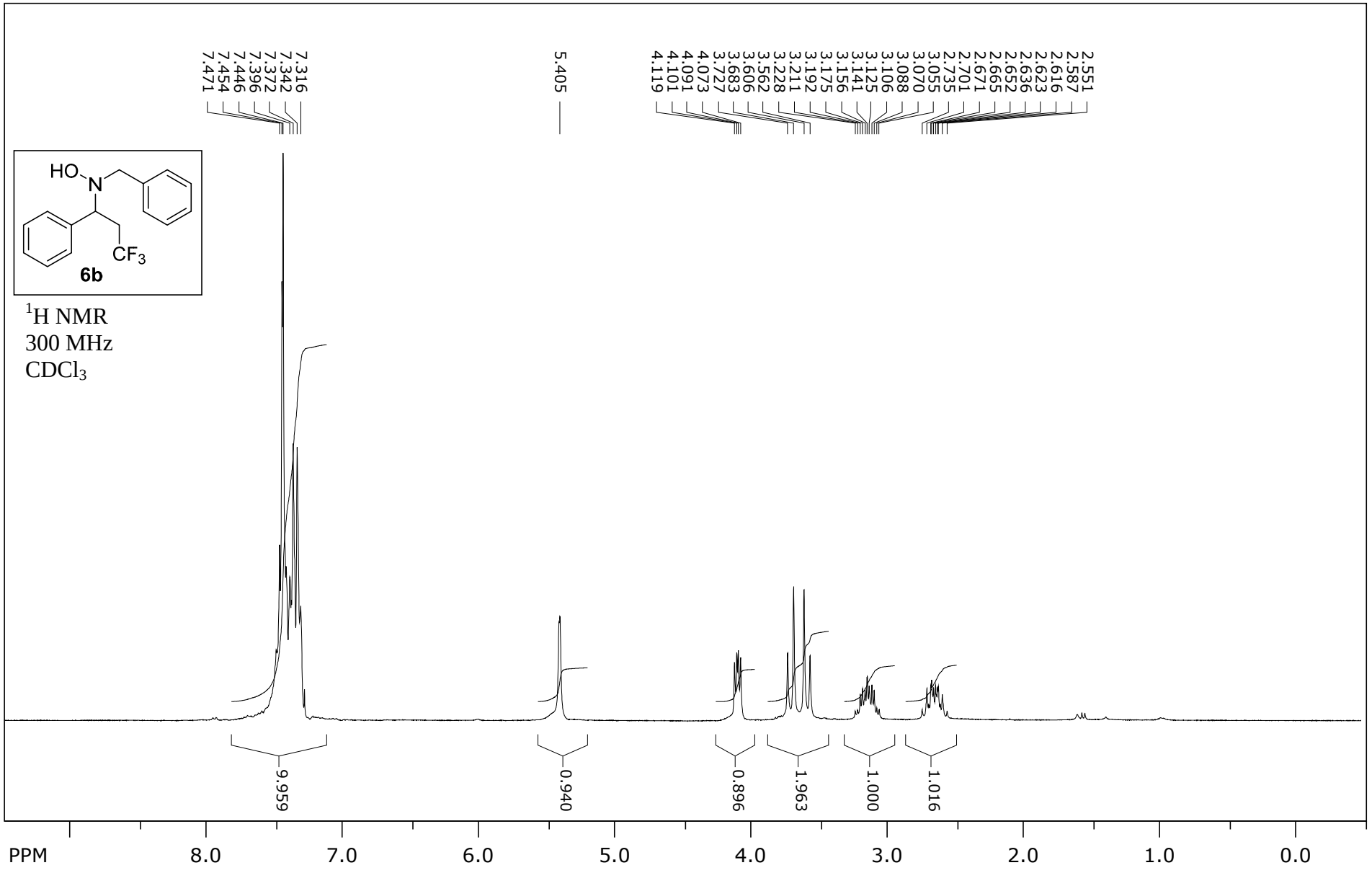


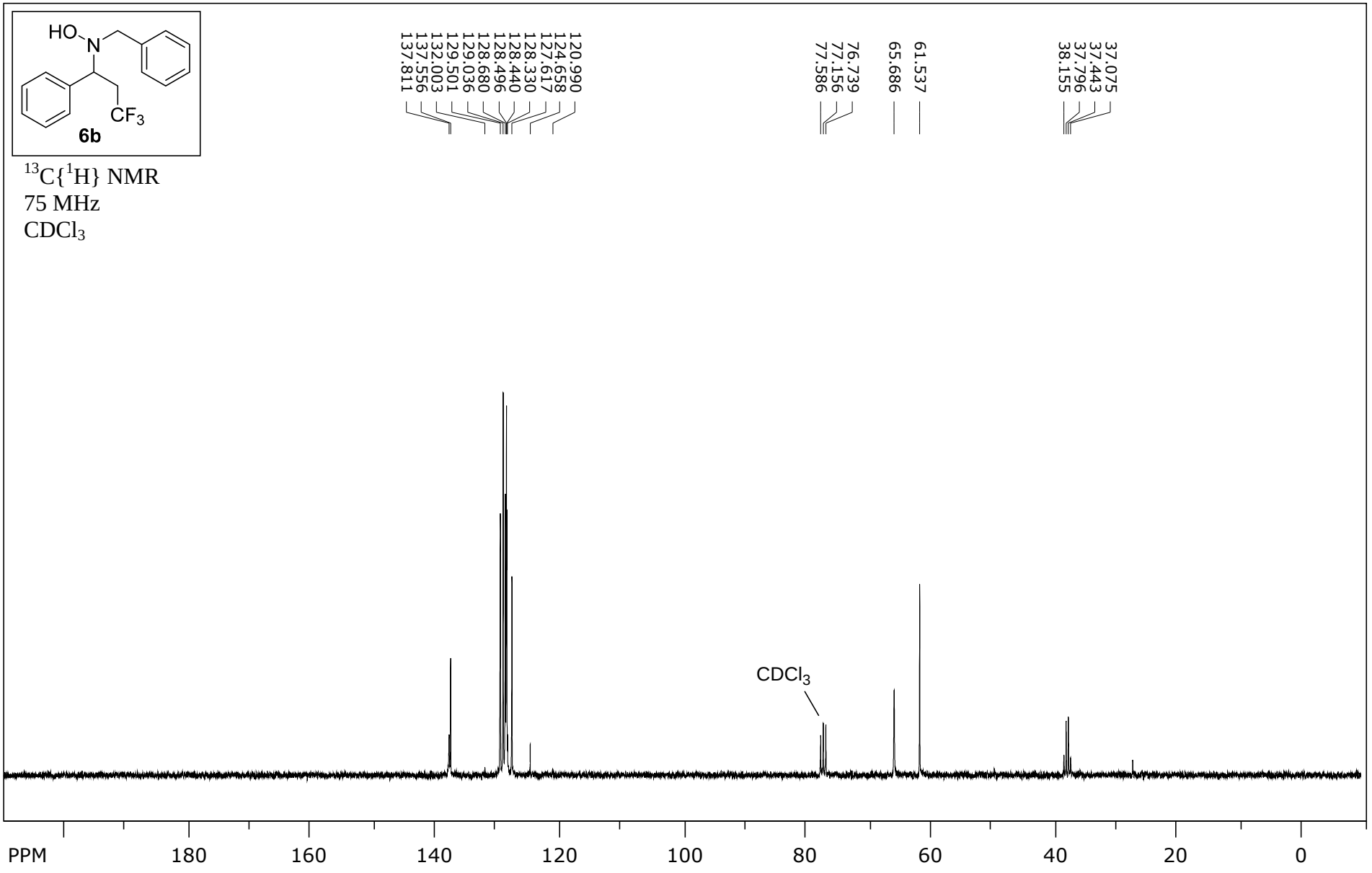
^{1}H NMR
300 MHz
$CDCl_3$


HO
N
Me
CF3
6a
13C{1H} NMR
75 MHz
CDCl3
137.749
131.880
128.813
128.774
128.579
128.216
124.546
120.871
77.583
77.160
76.736
67.957
46.091
38.110
37.750
37.390
37.023
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0

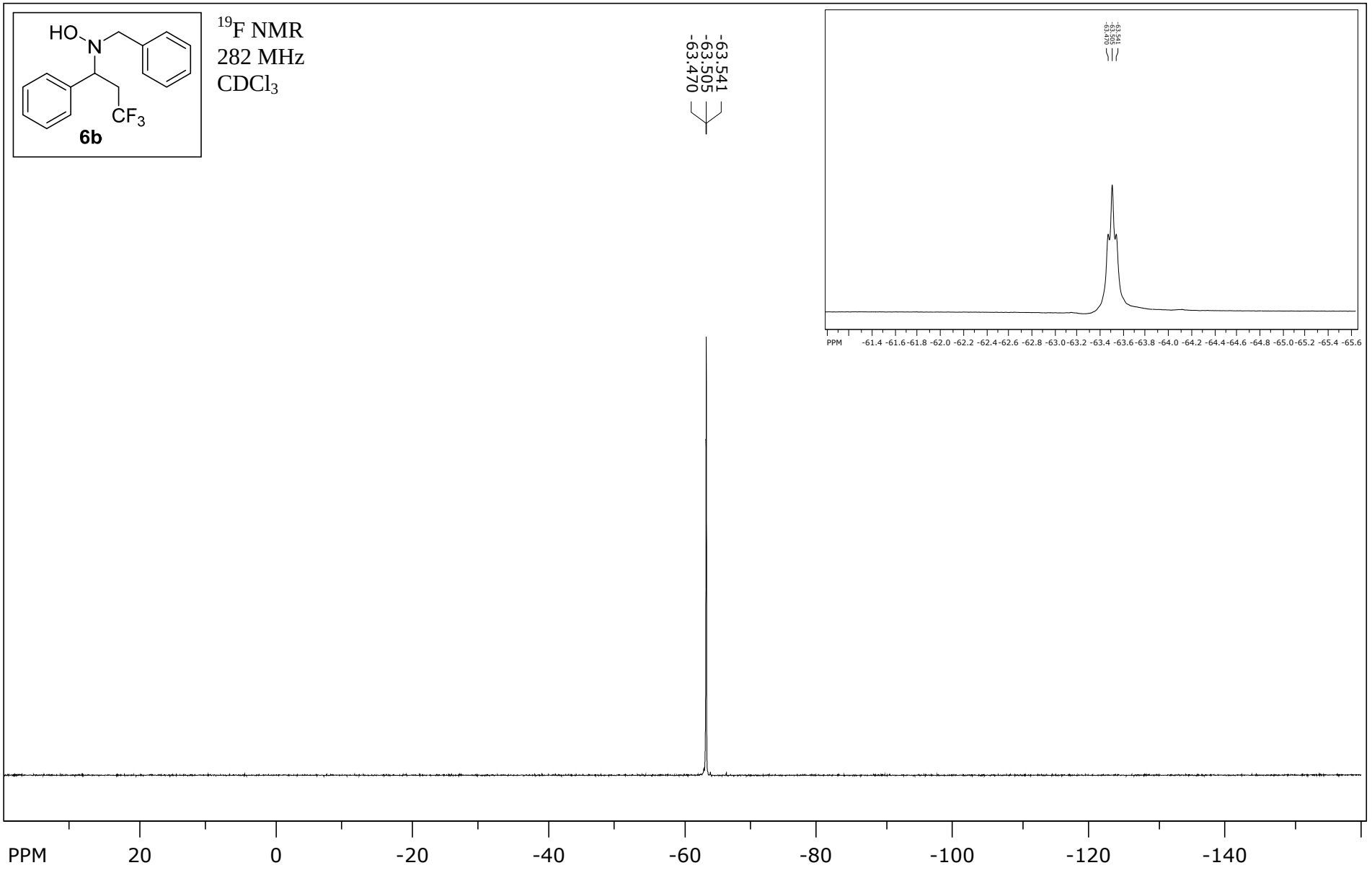


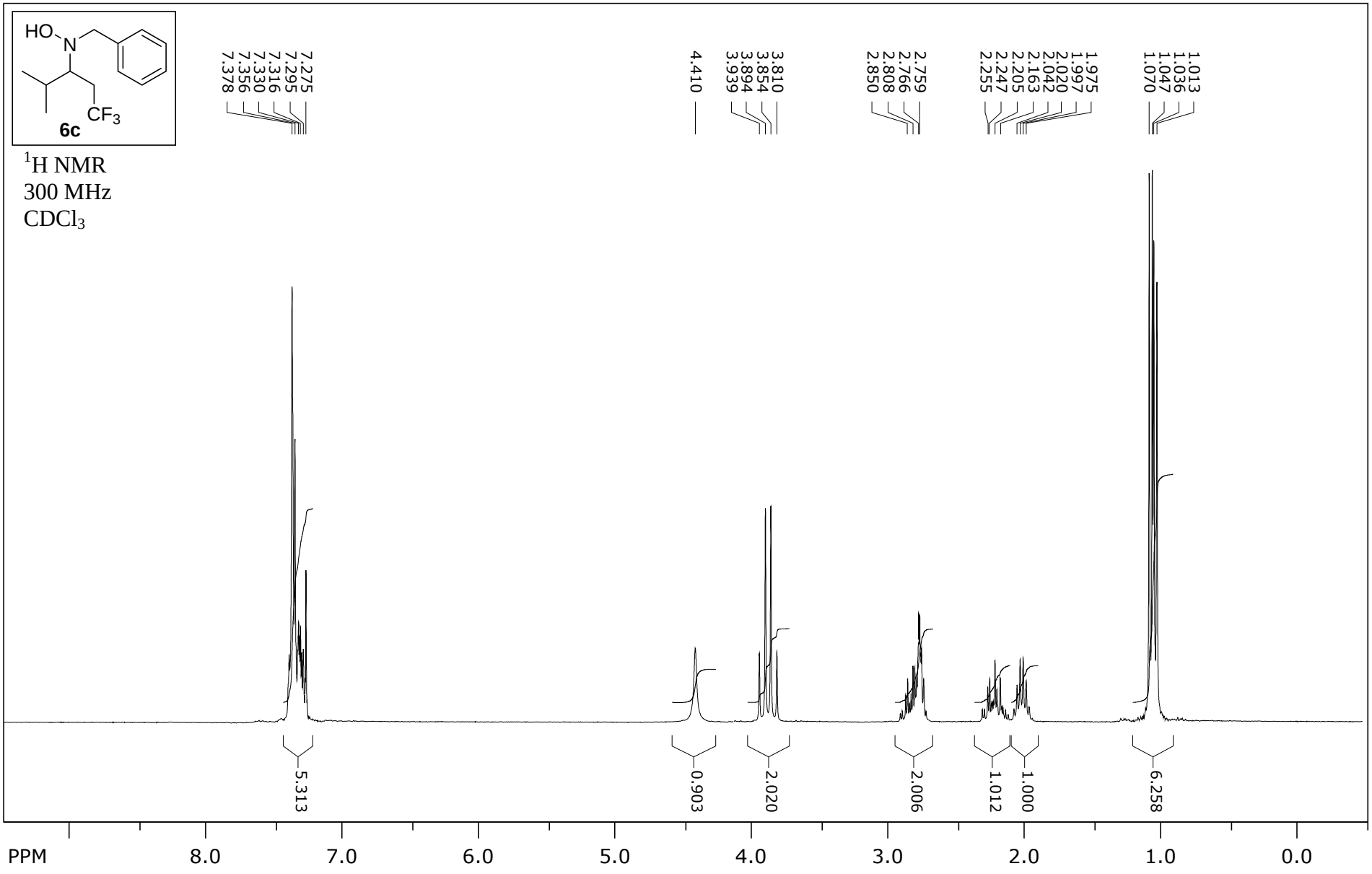
^{19}F NMR
282 MHz
$CDCl_3$

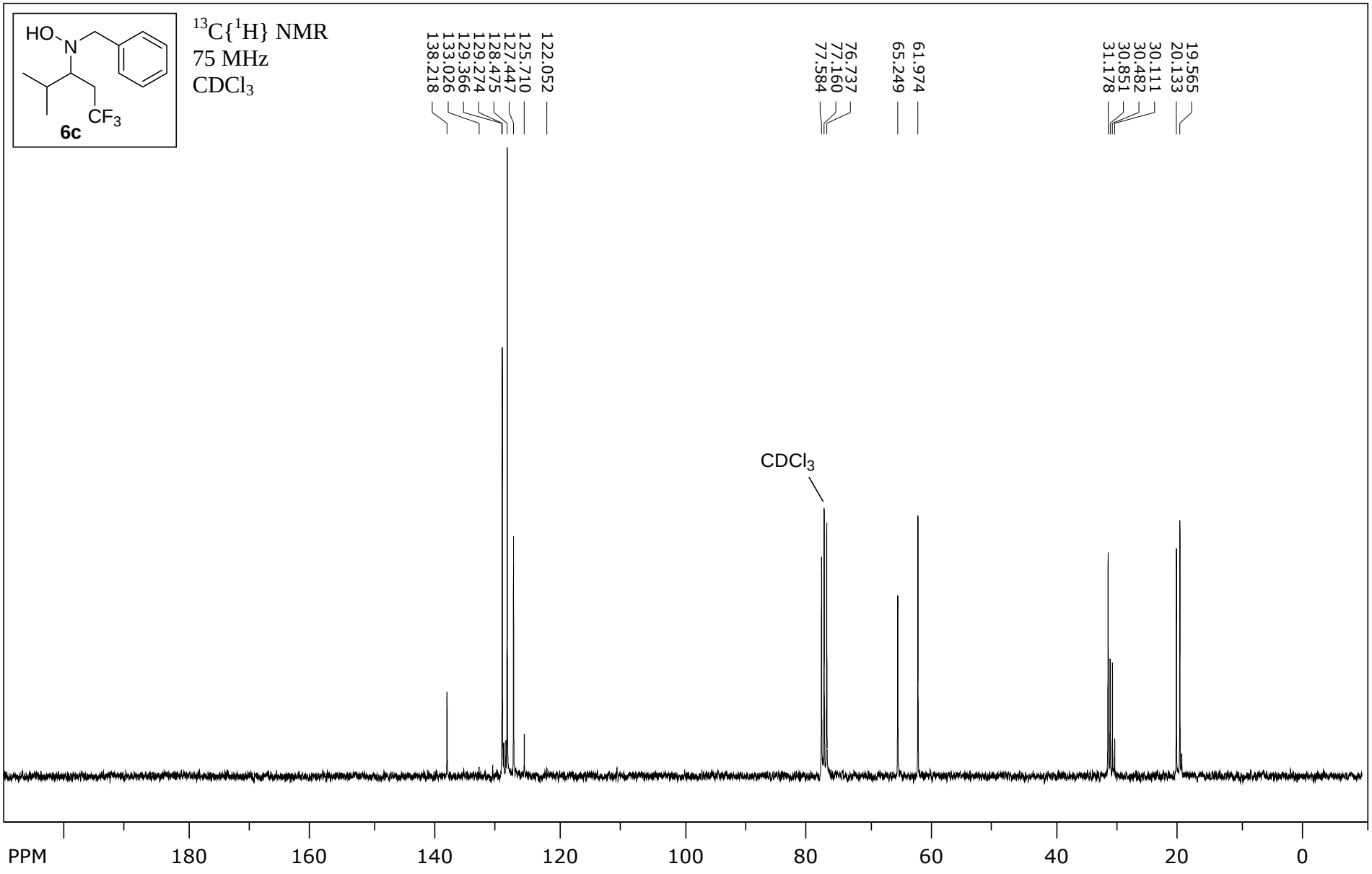

7.471
7.454
7.446
7.396
7.372
7.342
7.316
5.405
4.119
4.101
4.091
4.073
3.727
3.683
3.606
3.562
3.228
3.211
3.192
3.175
3.156
3.141
3.125
3.106
3.088
3.070
3.055
2.735
2.701
2.671
2.665
2.652
2.636
2.623
2.616
2.587
2.551
HO
N
CF3
6b
1H NMR
300 MHz
CDCl3
9.959
0.940
0.896
1.963
1.000
1.016
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

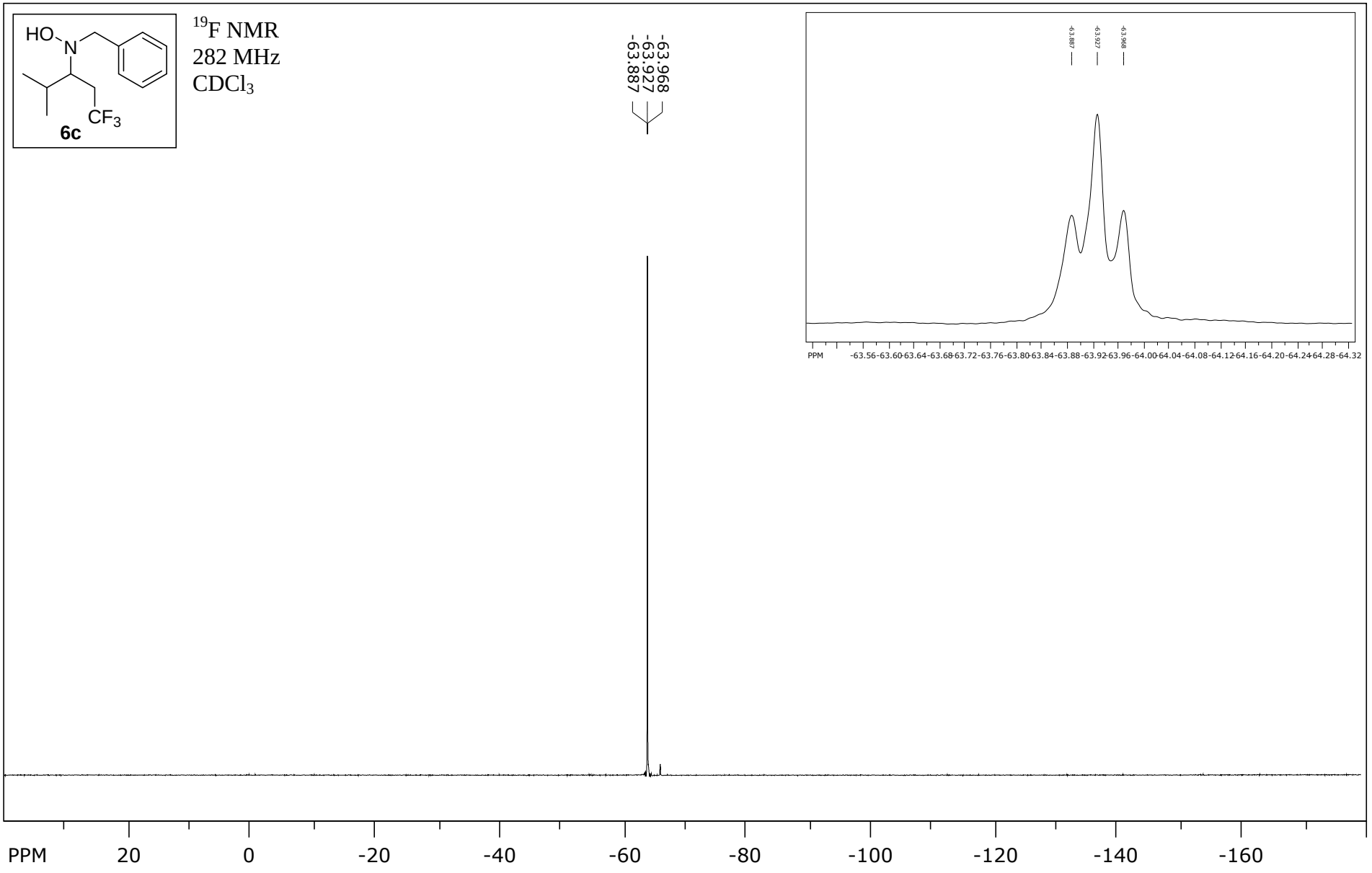


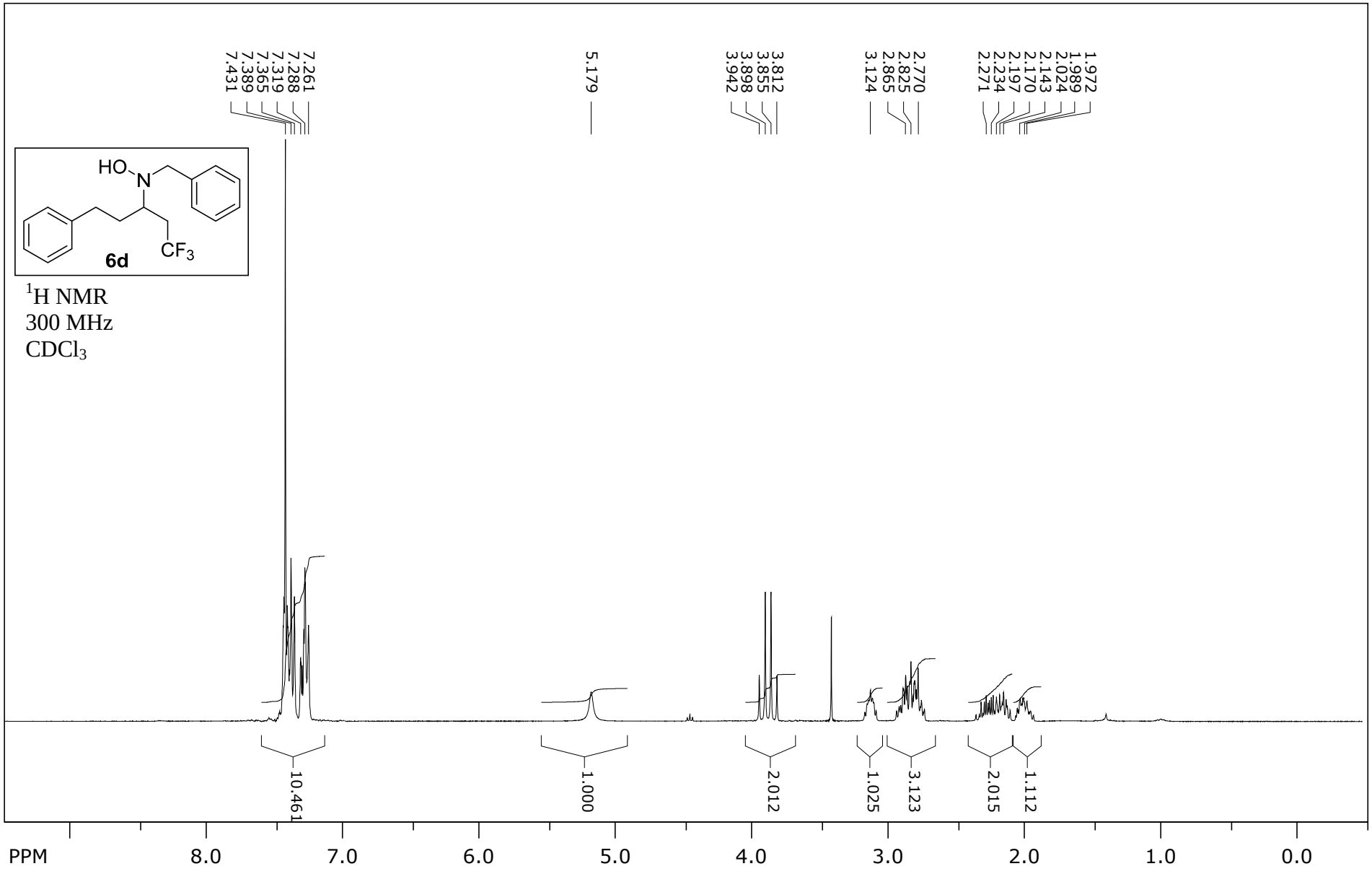
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$

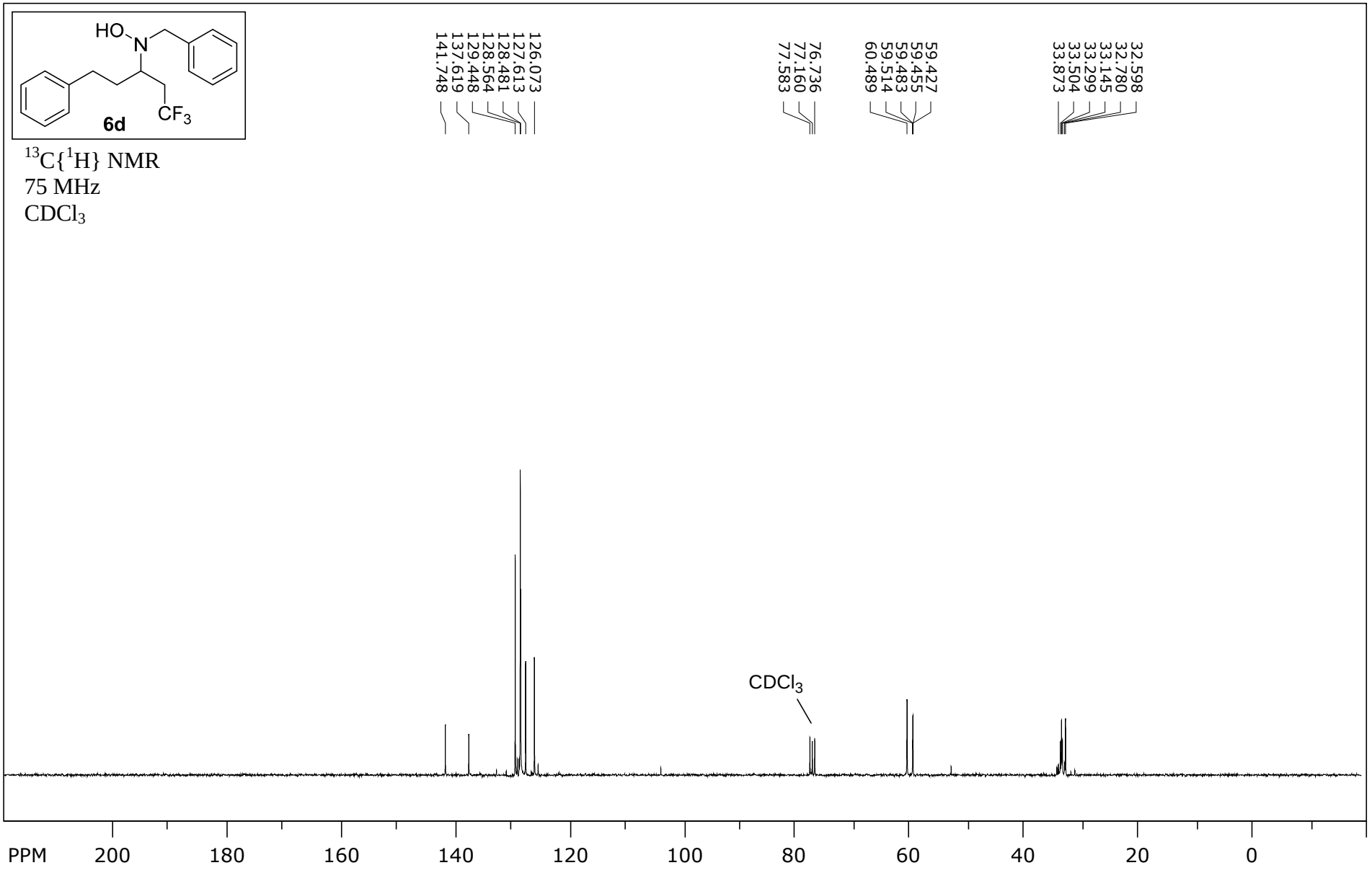

HO
N
CF3
6b
19F NMR
282 MHz
CDCl3
-63.541
-63.505
-63.470
PPM
20
0
-20
-40
-60
-80
-100
-120
-140
PPM
-61.4 -61.6 -61.8 -62.0 -62.2 -62.4 -62.6 -62.8 -63.0 -63.2 -63.4 -63.6 -63.8 -64.0 -64.2 -64.4 -64.6 -64.8 -65.0 -65.2 -65.4 -65.6


HO
N
CF3
6c
1H NMR
300 MHz
CDCl3
7.378
7.356
7.330
7.316
7.295
7.275
4.410
3.939
3.894
3.854
3.810
2.850
2.808
2.766
2.759
2.255
2.247
2.205
2.163
2.042
2.020
1.997
1.975
1.070
1.047
1.036
1.013
5.313
0.903
2.020
2.006
1.012
1.000
6.258
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

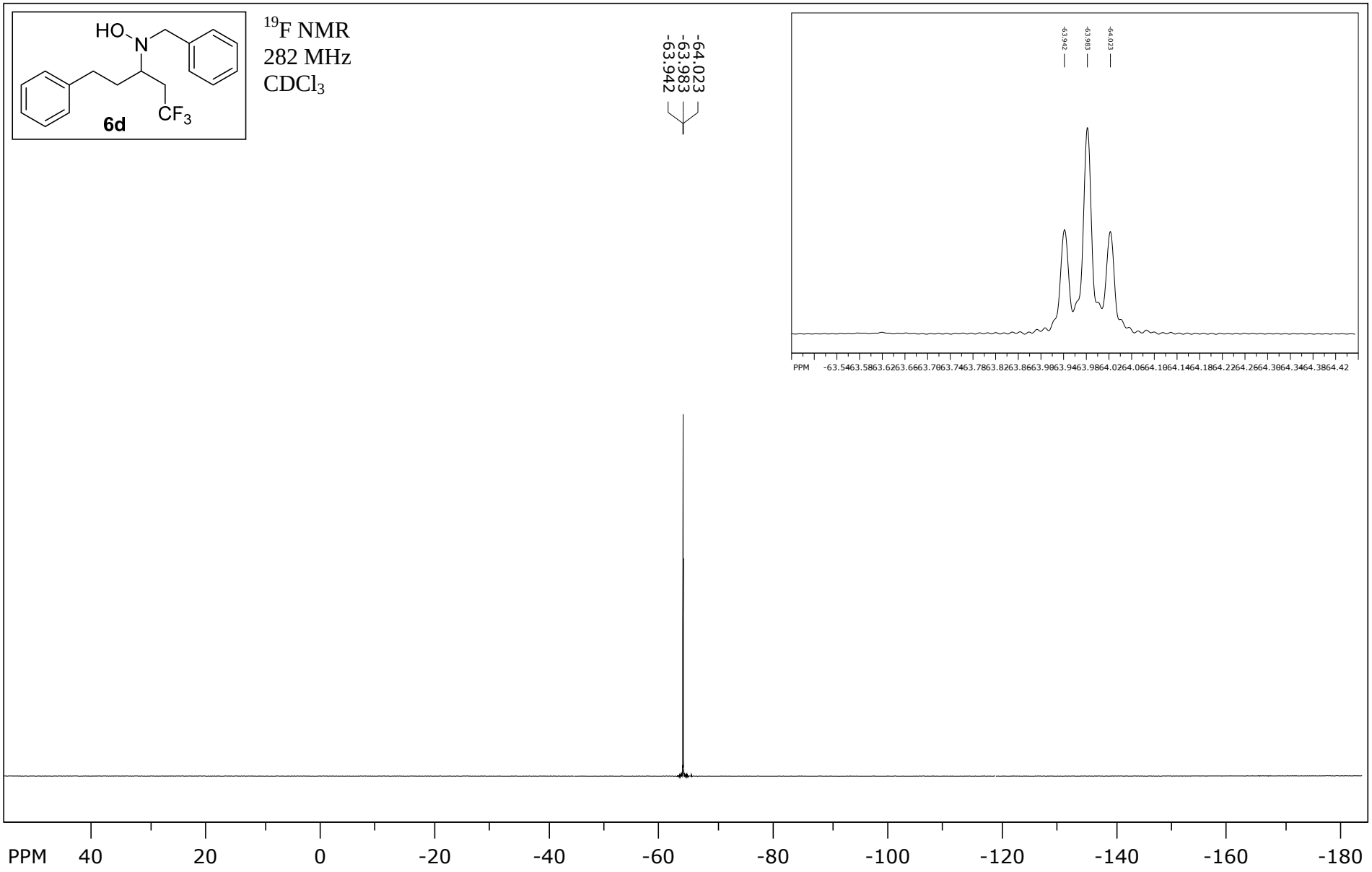

HO
N
CF3
6c
13C{1H} NMR
75 MHz
CDCl3
138.218
133.026
129.366
129.274
128.475
127.447
125.710
122.052
77.584
77.160
76.737
65.249
61.974
31.178
30.851
30.482
30.111
20.133
19.565
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0

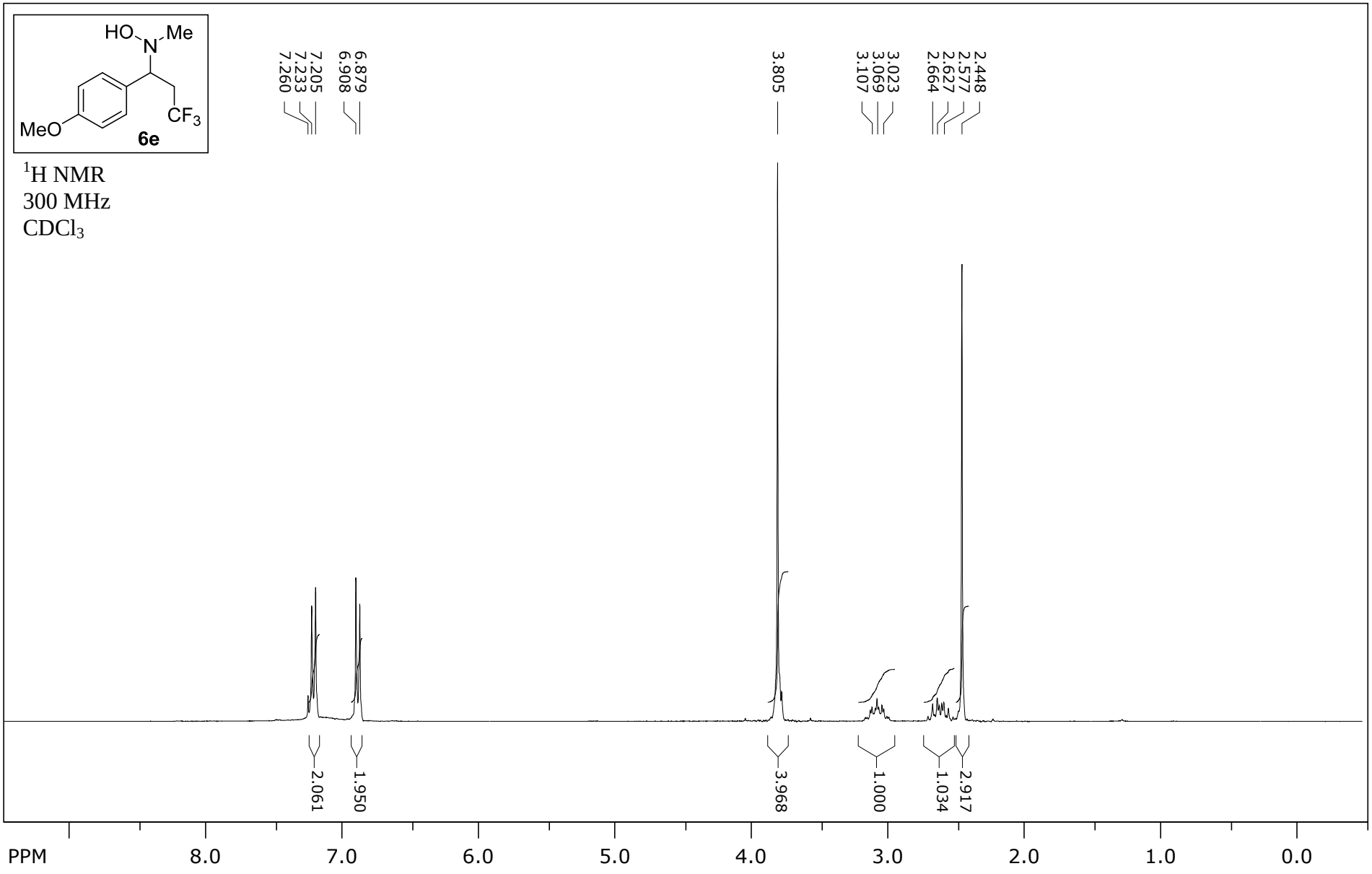

HO
N
CF3
6c
19F NMR
282 MHz
CDCl3
-63.887
-63.927
-63.968
PPM
20
0
-20
-40
-60
-80
-100
-120
-140
-160

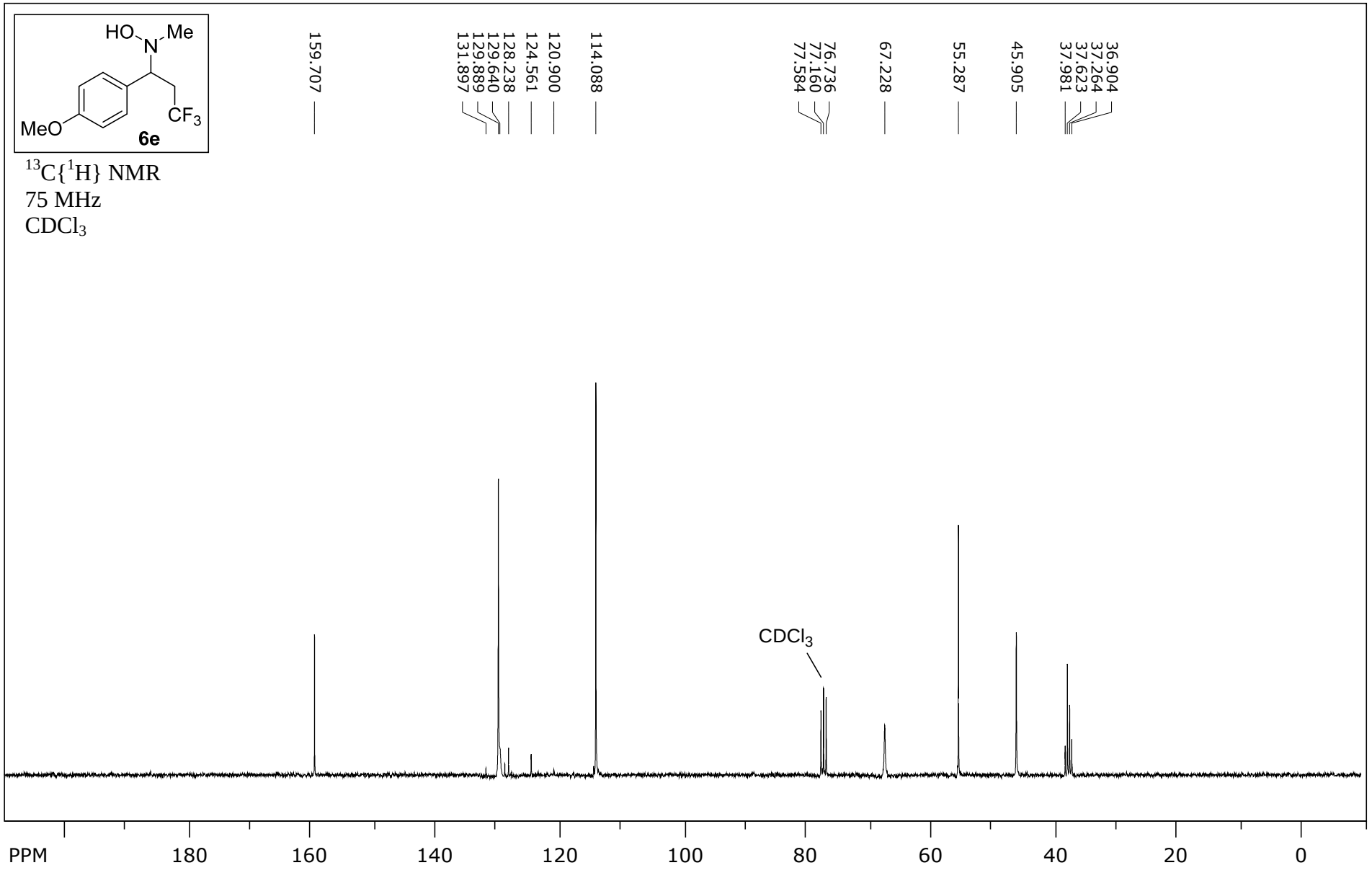

7.431
7.389
7.365
7.319
7.288
7.261
5.179
3.942
3.898
3.855
3.812
3.124
2.865
2.825
2.770
2.271
2.234
2.197
2.170
2.143
2.024
1.989
1.972
HO
N
CF3
6d
1H NMR
300 MHz
CDCl3
10.461
1.000
2.012
1.025
3.123
2.015
1.112
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0



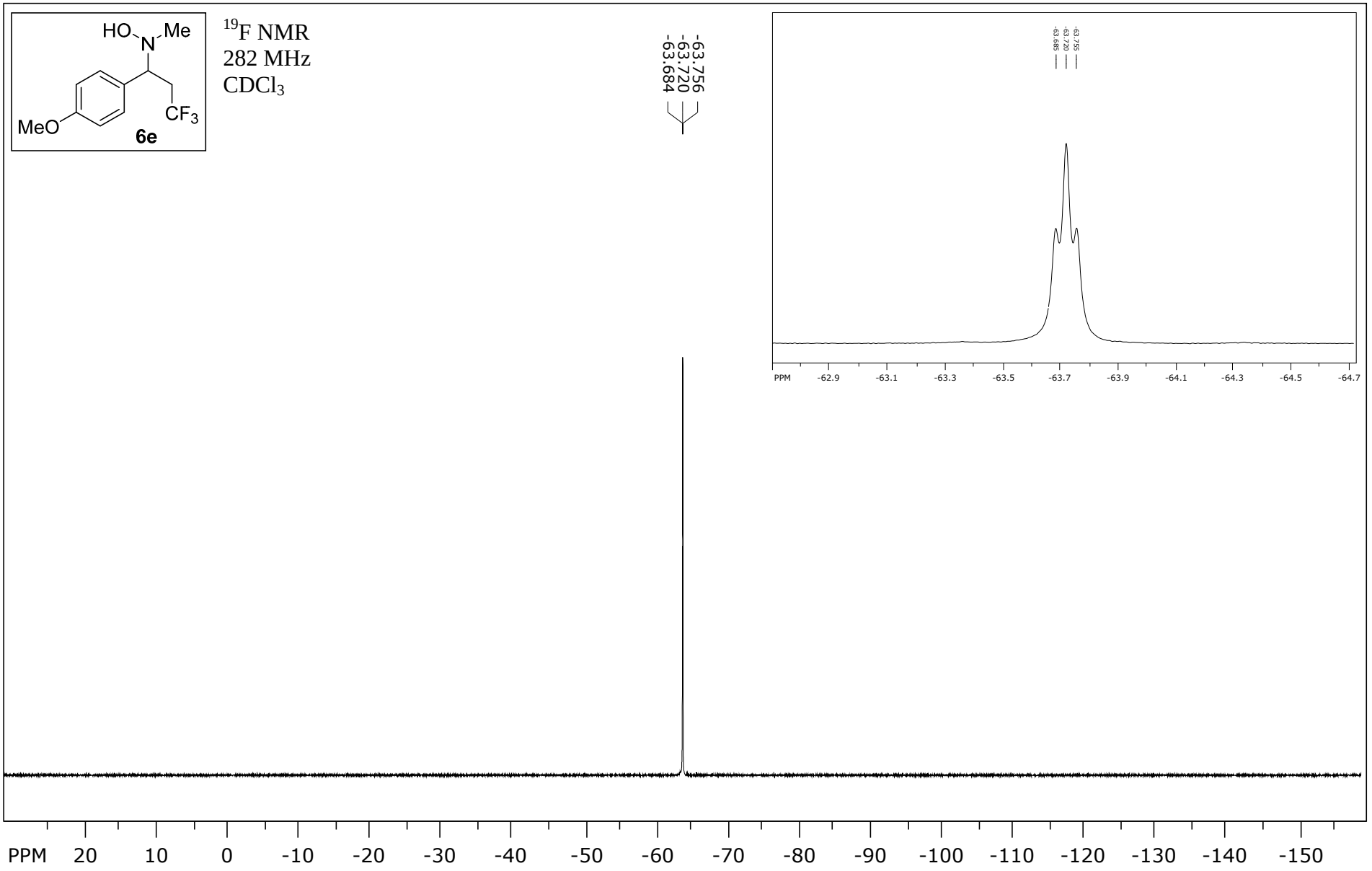
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$

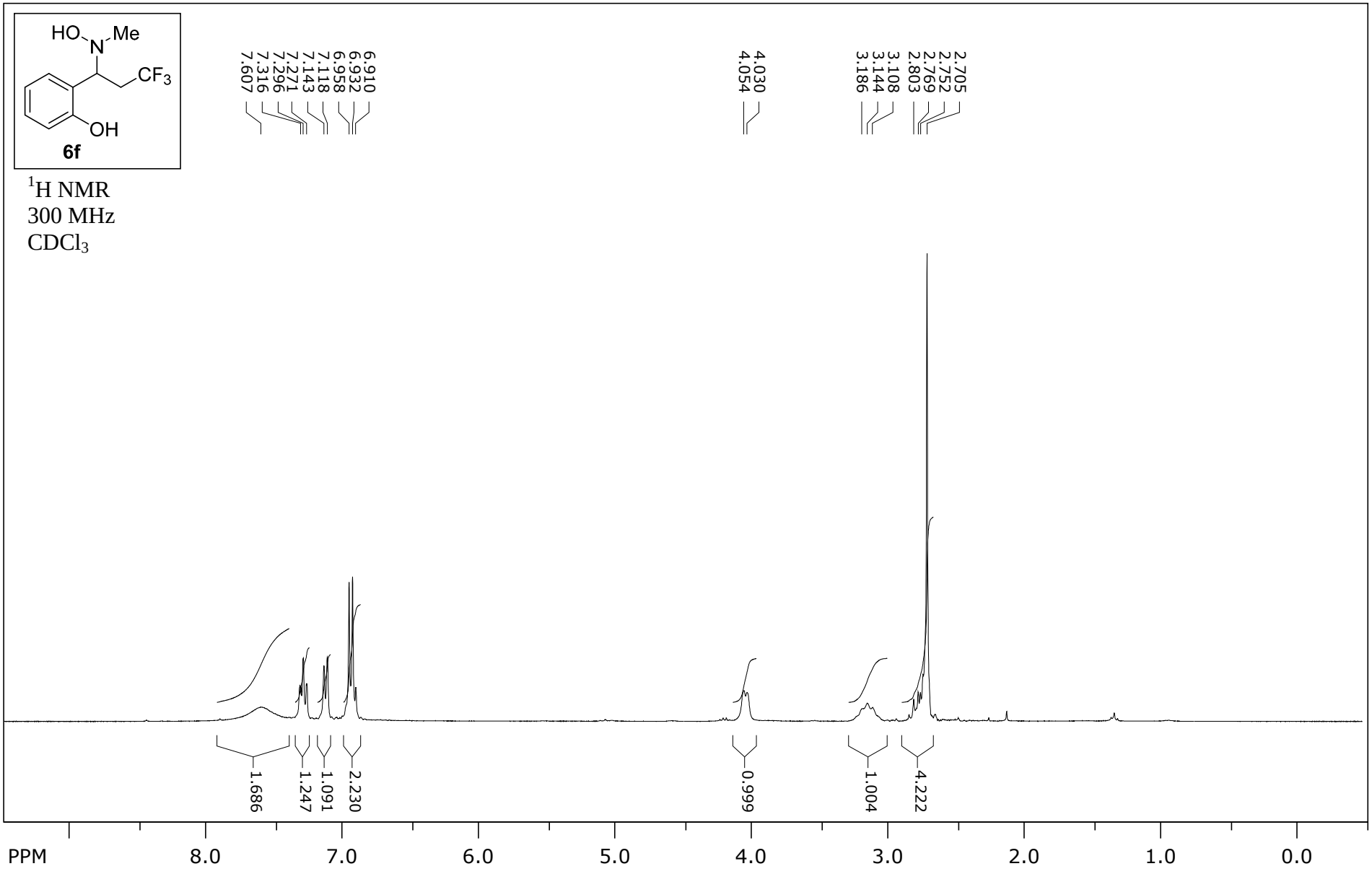

HO
N
CF3
6d
19F NMR
282 MHz
CDCl3
-63.942
-63.983
-64.023
PPM
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180


HO
N
Me
MeO
CF3
6e
1H NMR
300 MHz
CDCl3
7.260
7.233
7.205
6.908
6.879
3.805
3.107
3.069
3.023
2.664
2.627
2.577
2.448
2.061
1.950
3.968
1.000
1.034
2.917
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

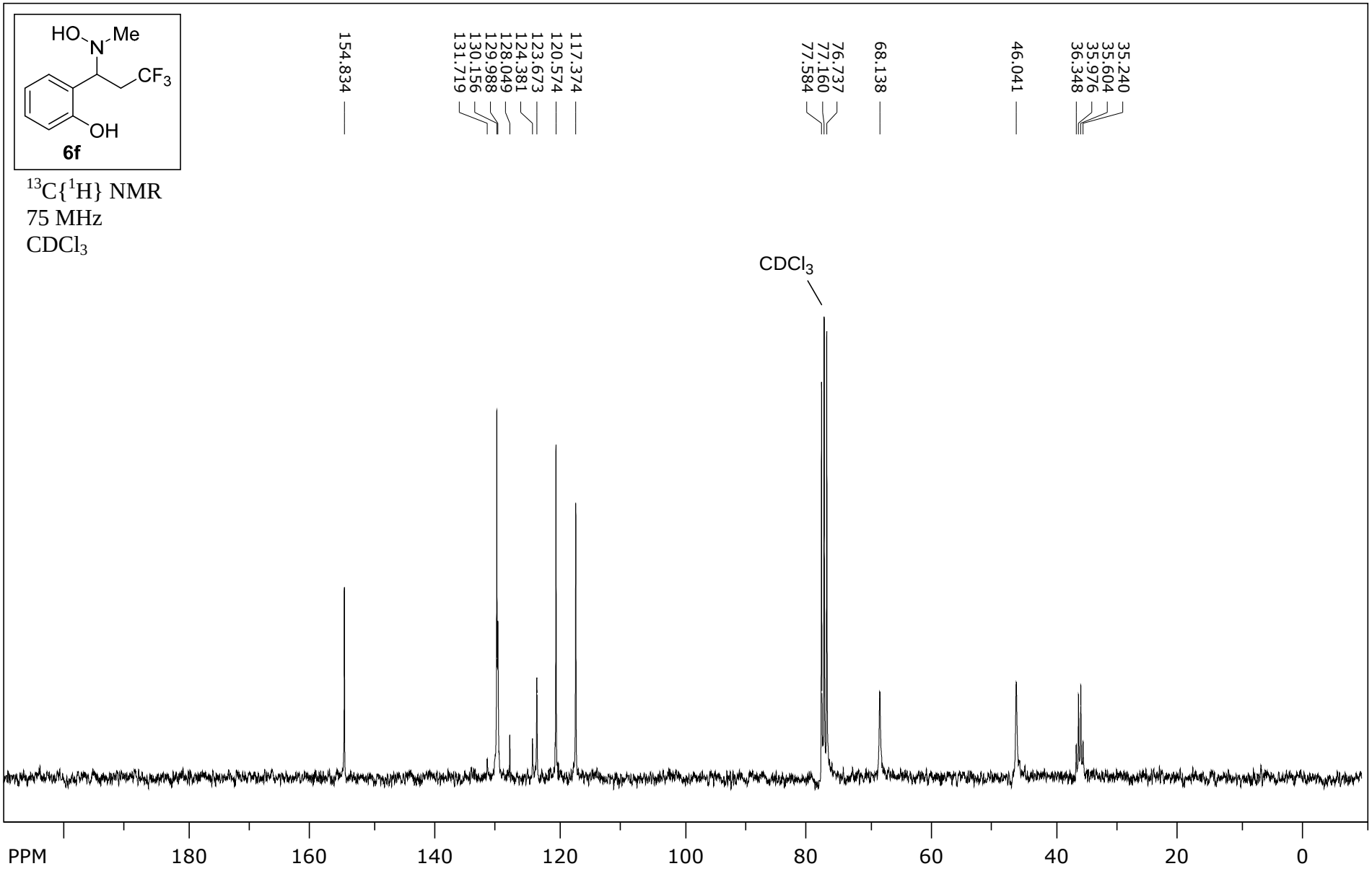


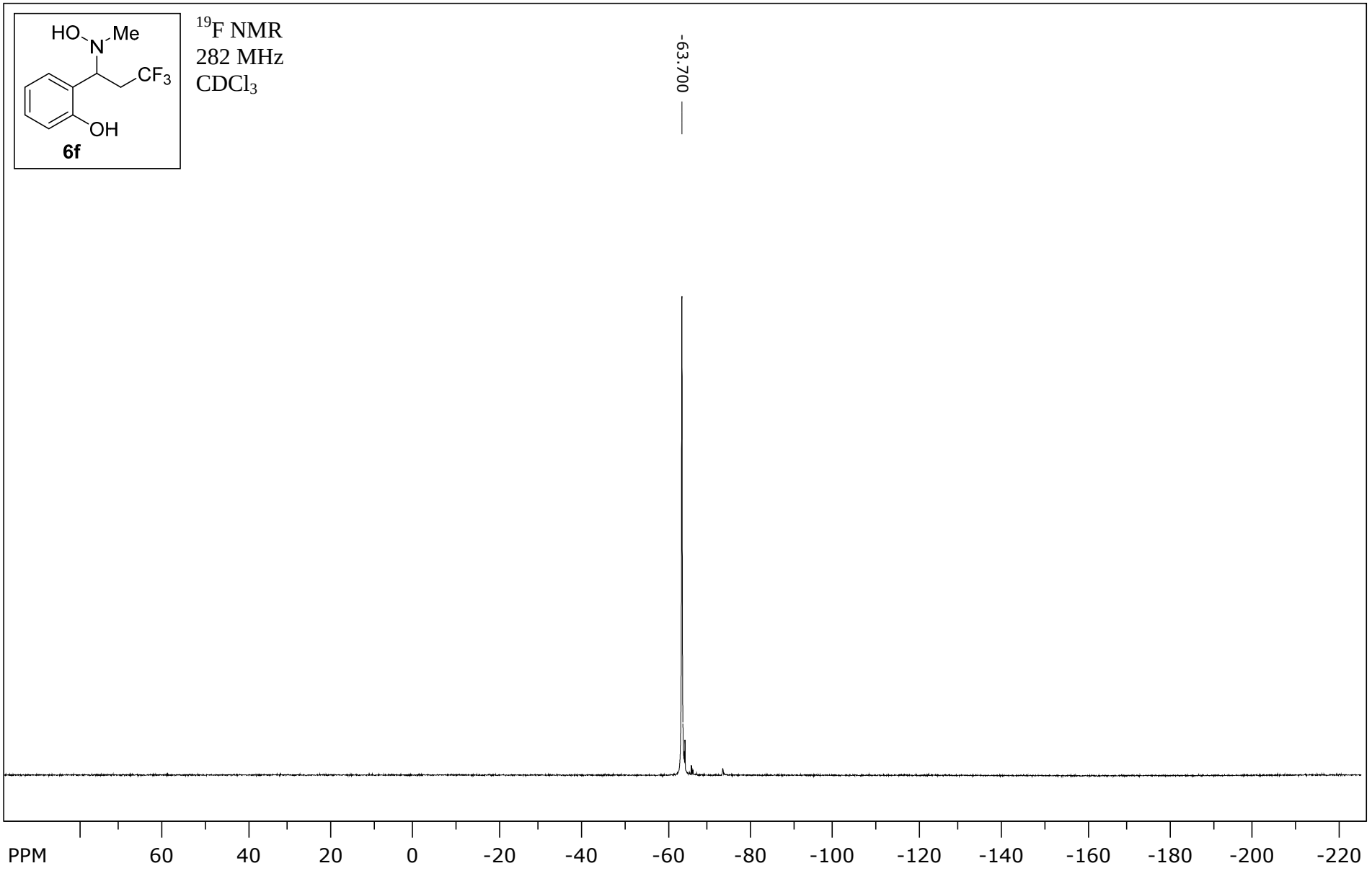
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$

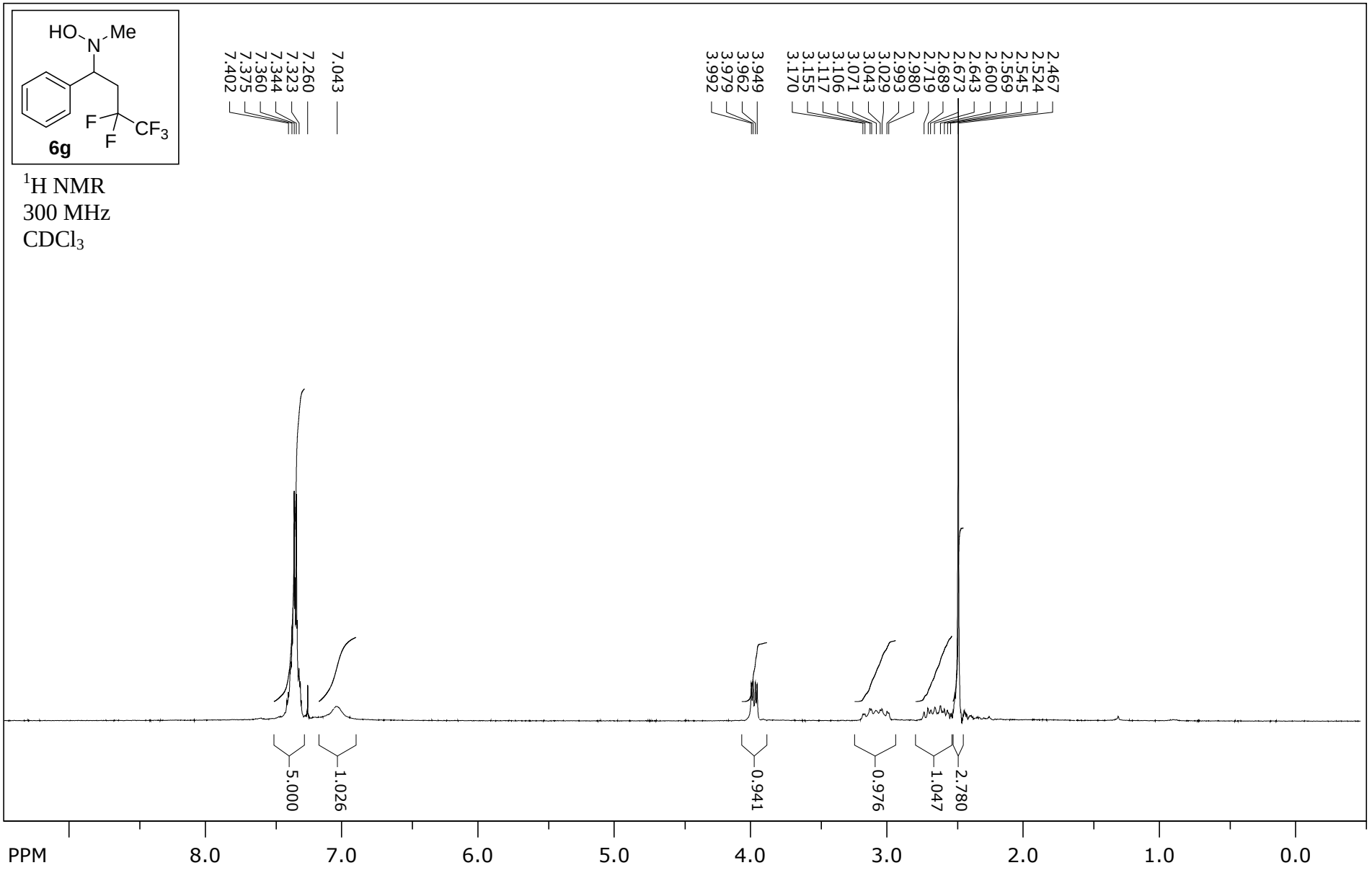

HO
N
Me
MeO
CF3
6e
19F NMR
282 MHz
CDCl3
-63.684
-63.720
-63.756
-63.685
-63.720
-63.755
PPM -62.9 -63.1 -63.3 -63.5 -63.7 -63.9 -64.1 -64.3 -64.5 -64.7
PPM 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150

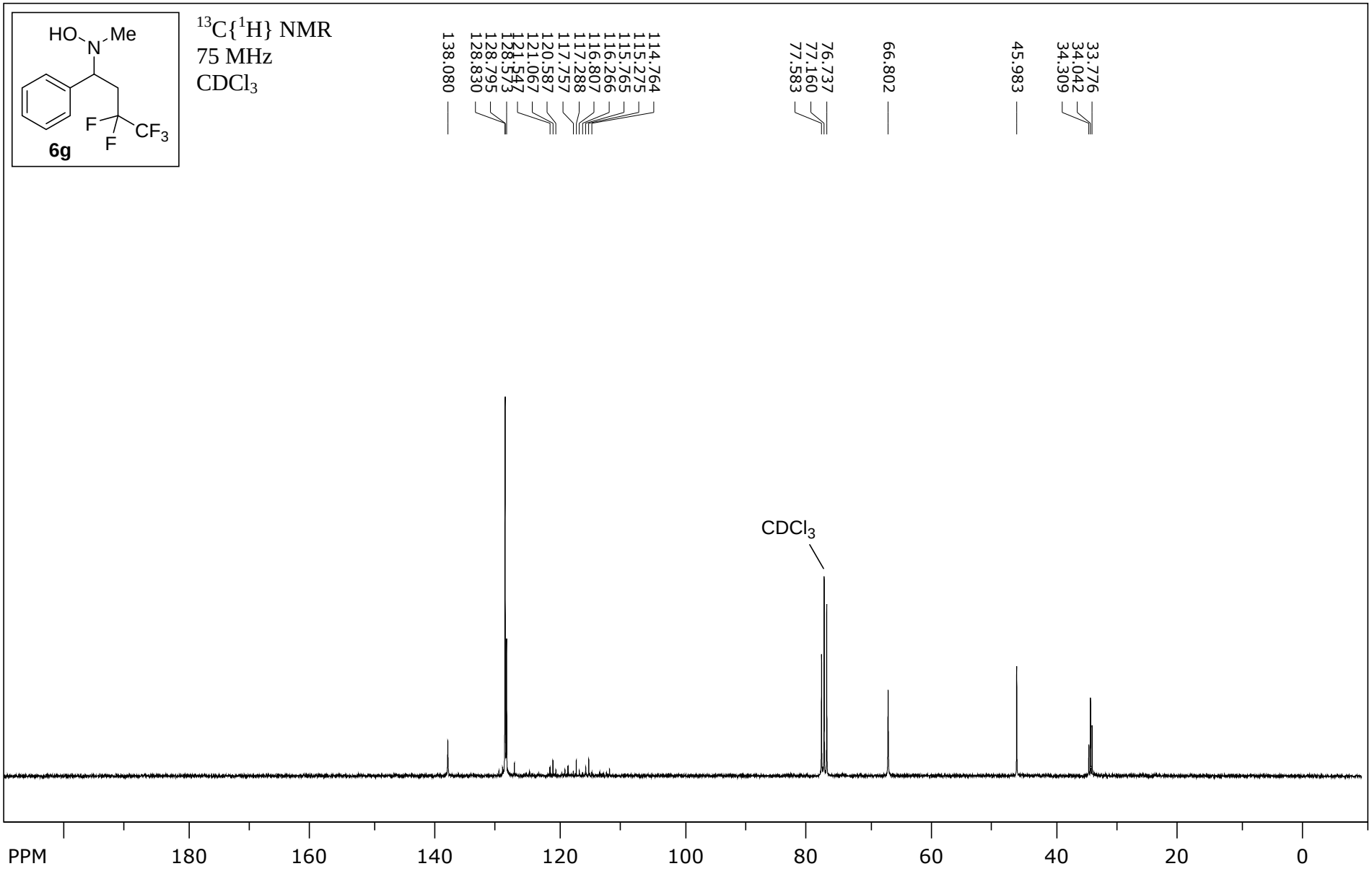


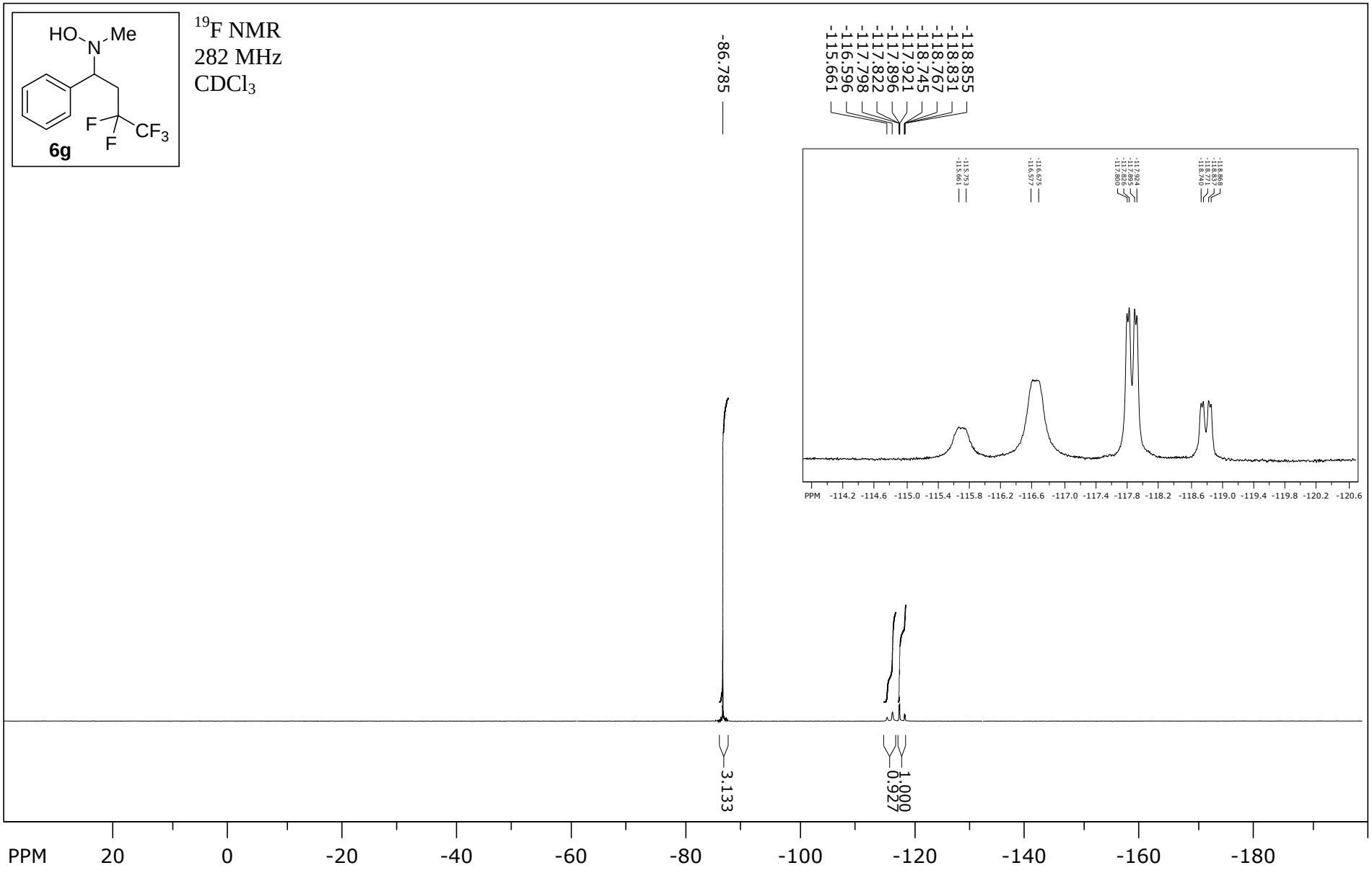
^{1}H NMR
300 MHz
$CDCl_3$

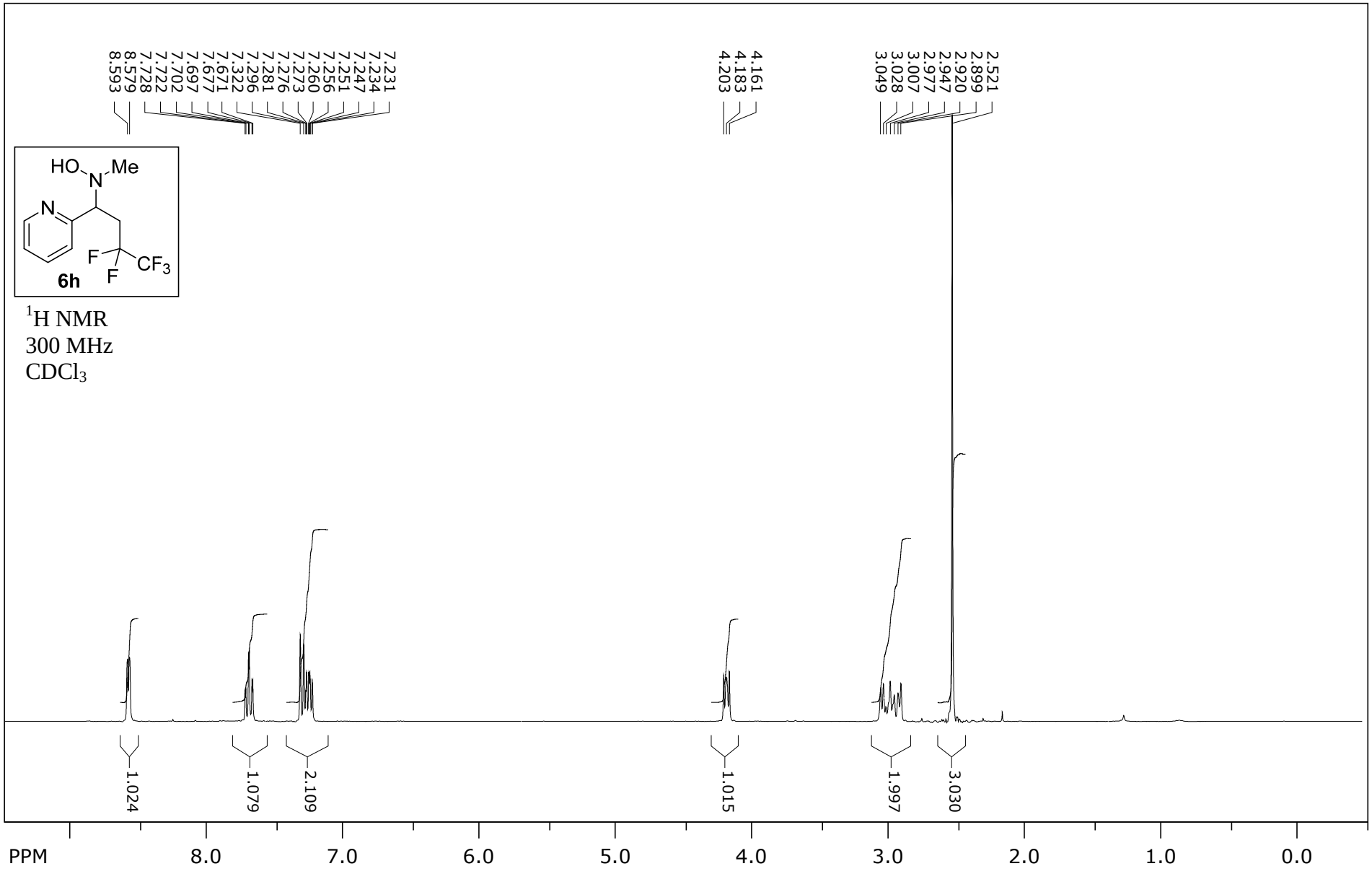

HO
N
Me
CF3
OH
6f
154.834
131.719
130.156
129.988
128.049
124.381
123.673
120.574
117.374
77.584
77.160
76.737
68.138
46.041
36.348
35.976
35.604
35.240
13C{1H} NMR
75 MHz
CDCl3
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0

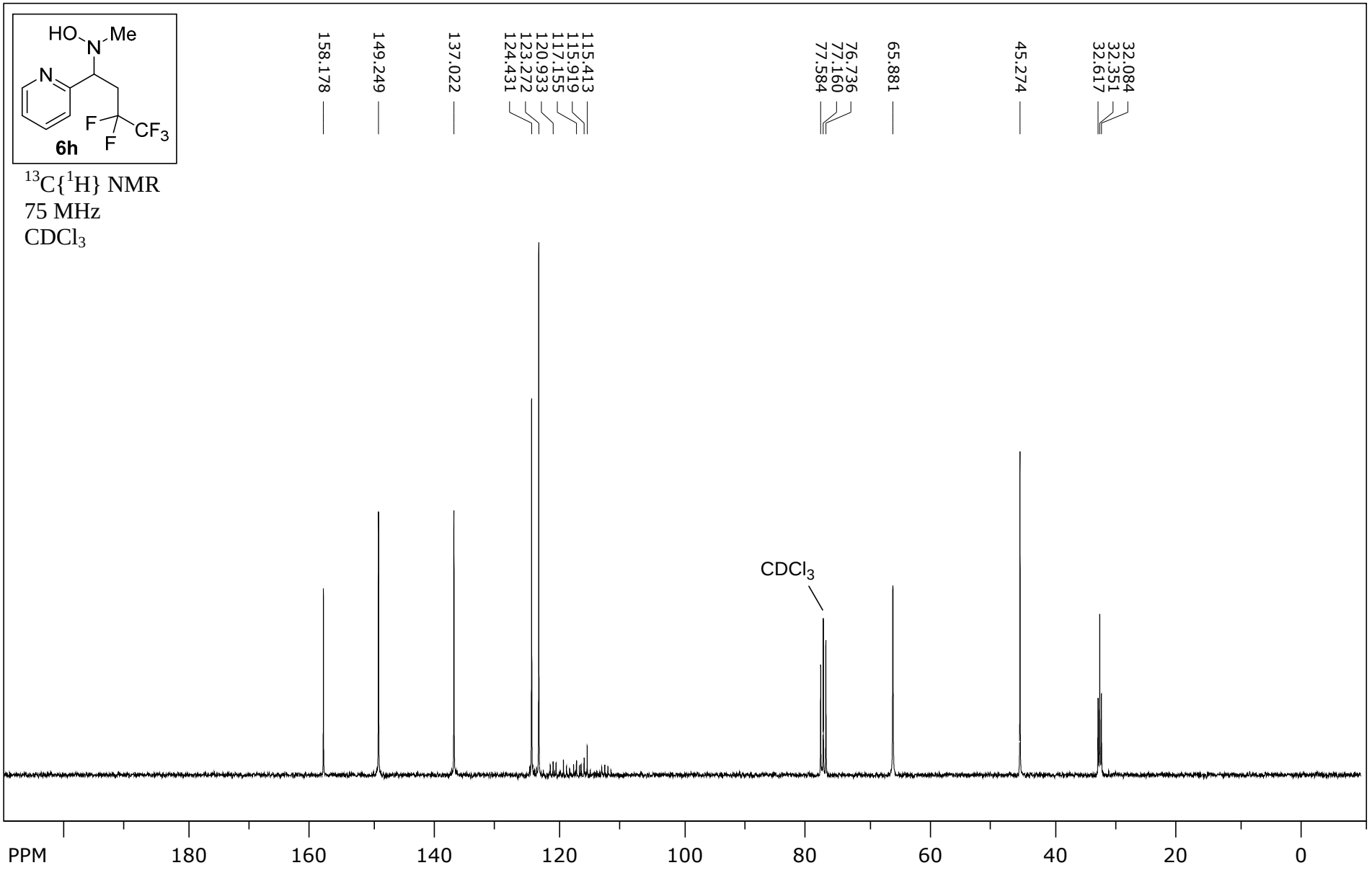

HO
N
Me
CF3
OH
6f
19F NMR
282 MHz
CDCl3
-63.700
PPM
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
-220


HO
N
Me
F
F
CF3
6g
1H NMR
300 MHz
CDCl3
7.402
7.375
7.360
7.344
7.323
7.260
7.043
3.992
3.979
3.962
3.949
3.170
3.155
3.117
3.106
3.071
3.043
3.029
2.993
2.980
2.719
2.689
2.673
2.643
2.600
2.569
2.545
2.524
2.467
5.000
1.026
0.941
0.976
1.047
2.780
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

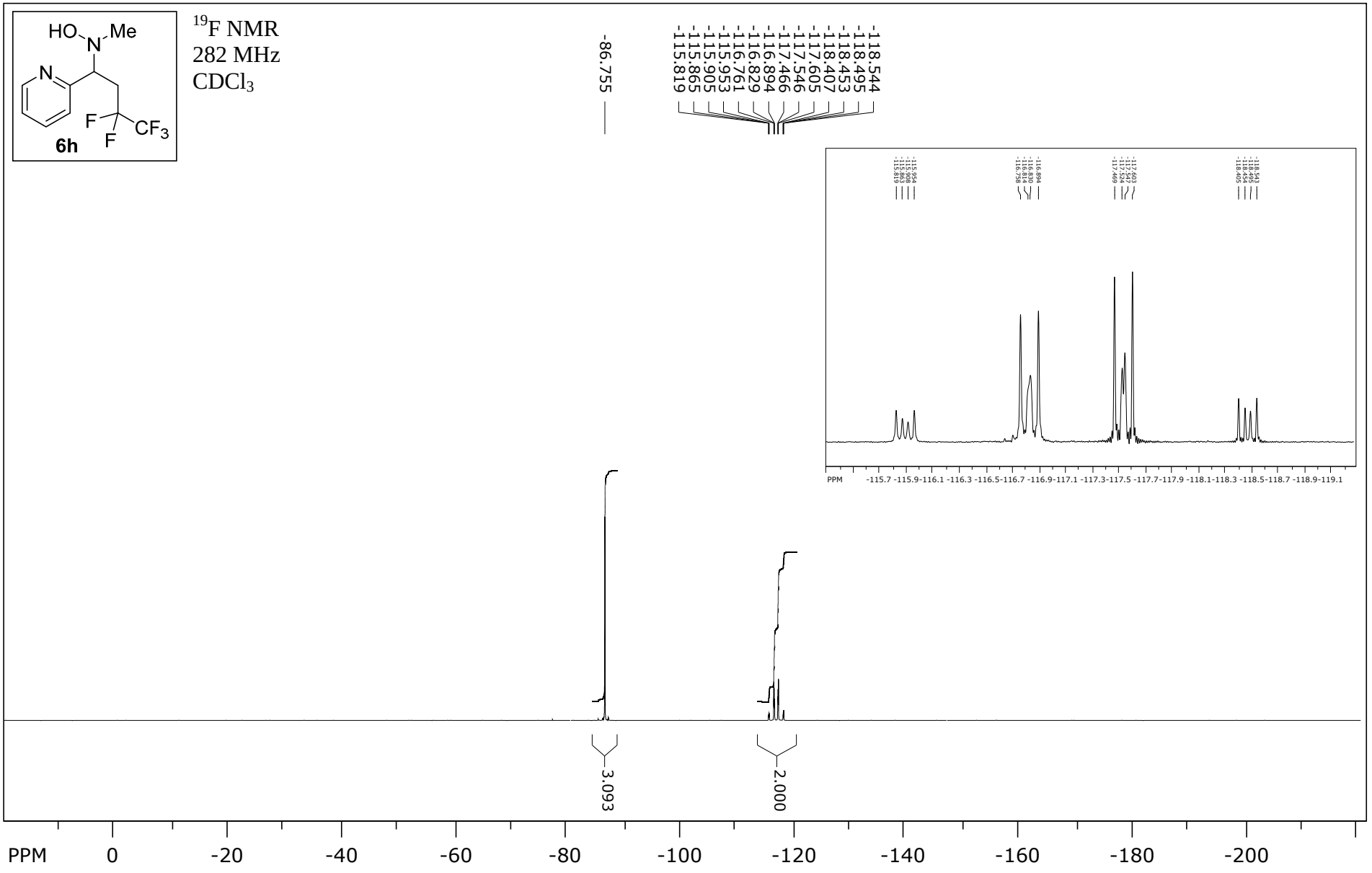

HO
N
Me
F
F
CF3
6g
13C{1H} NMR
75 MHz
CDCl3
138.080
128.830
128.795
128.573
121.547
121.067
120.587
117.757
117.288
116.807
116.266
115.765
115.275
114.764
77.583
77.160
76.737
66.802
45.983
34.309
34.042
33.776
CDCl3
PPM
180
160
140
120
100
80
60
40
20
0

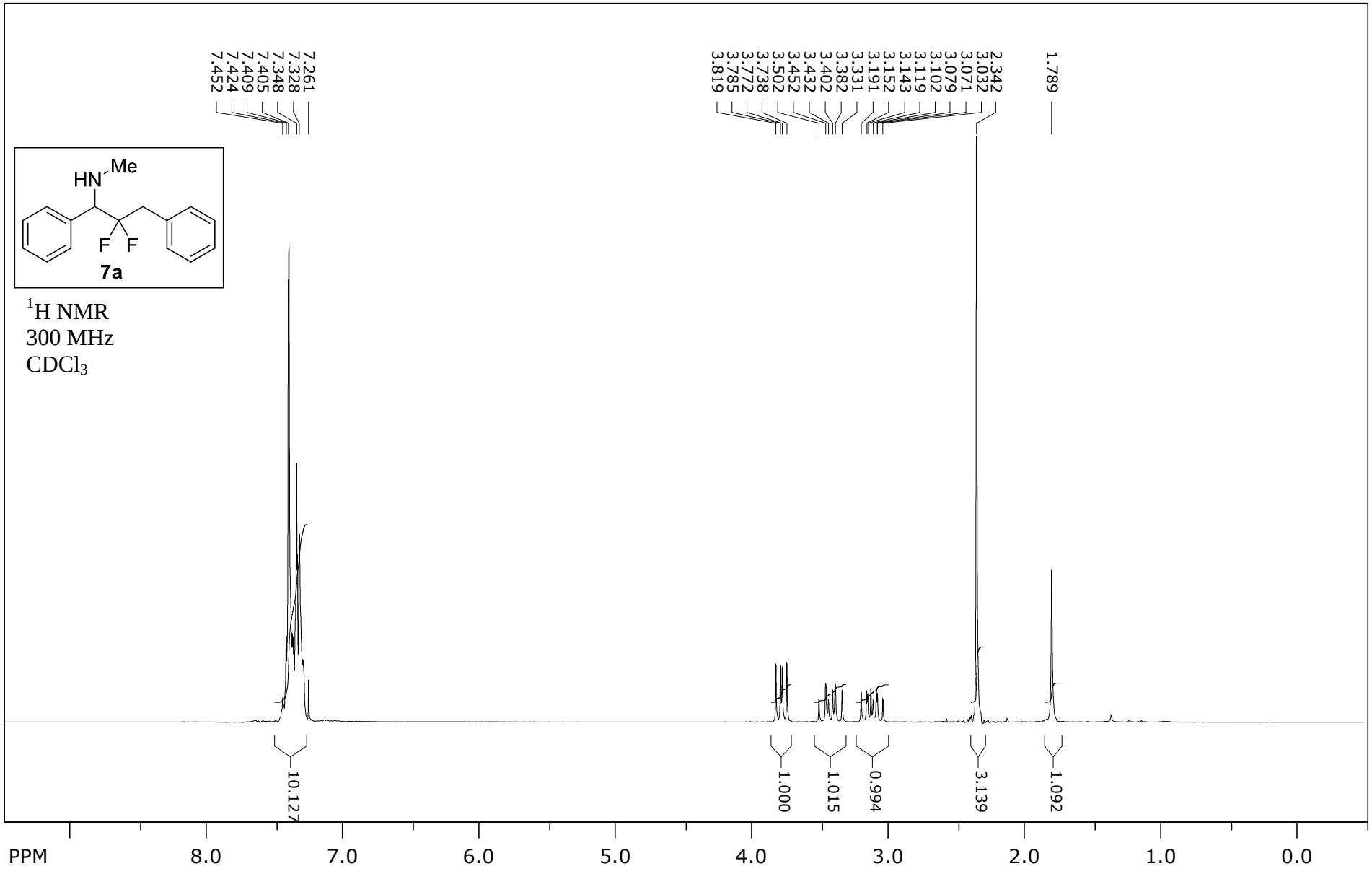

HO
N
Me
F
F
CF3
6g
19F NMR
282 MHz
CDCl3
-86.785
-115.661
-116.596
-117.798
-117.822
-117.896
-117.921
-118.745
-118.767
-118.831
-118.855
-115.753
-115.661
-116.675
-116.577
-117.924
-117.895
-117.826
-117.800
-118.868
-118.837
-118.777
-118.740
PPM -114.2 -114.6 -115.0 -115.4 -115.8 -116.2 -116.6 -117.0 -117.4 -117.8 -118.2 -118.6 -119.0 -119.4 -119.8 -120.2 -120.6
3.133
0.927
1.000
PPM 20 0 -20 -40 -60 -80 -100 -120 -140 -160 -180

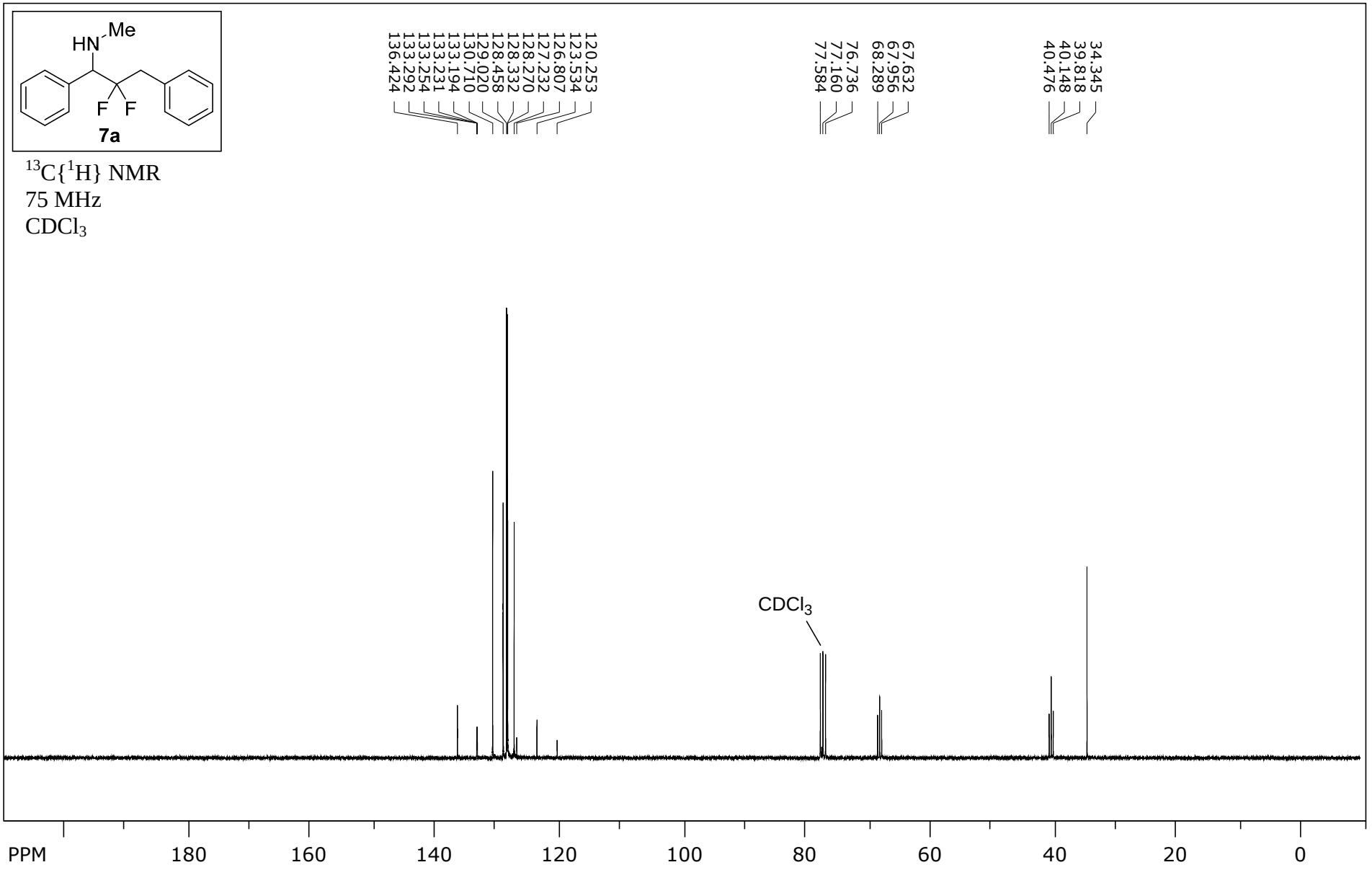

8.593
8.579
7.728
7.722
7.702
7.697
7.677
7.671
7.322
7.296
7.281
7.276
7.273
7.260
7.256
7.251
7.247
7.234
7.231
4.203
4.183
4.161
3.049
3.028
3.007
2.977
2.947
2.920
2.899
2.521
HO
N
Me
N
F
F
CF3
6h
1H NMR
300 MHz
CDCl3
1.024
1.079
2.109
1.015
1.997
3.030
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0



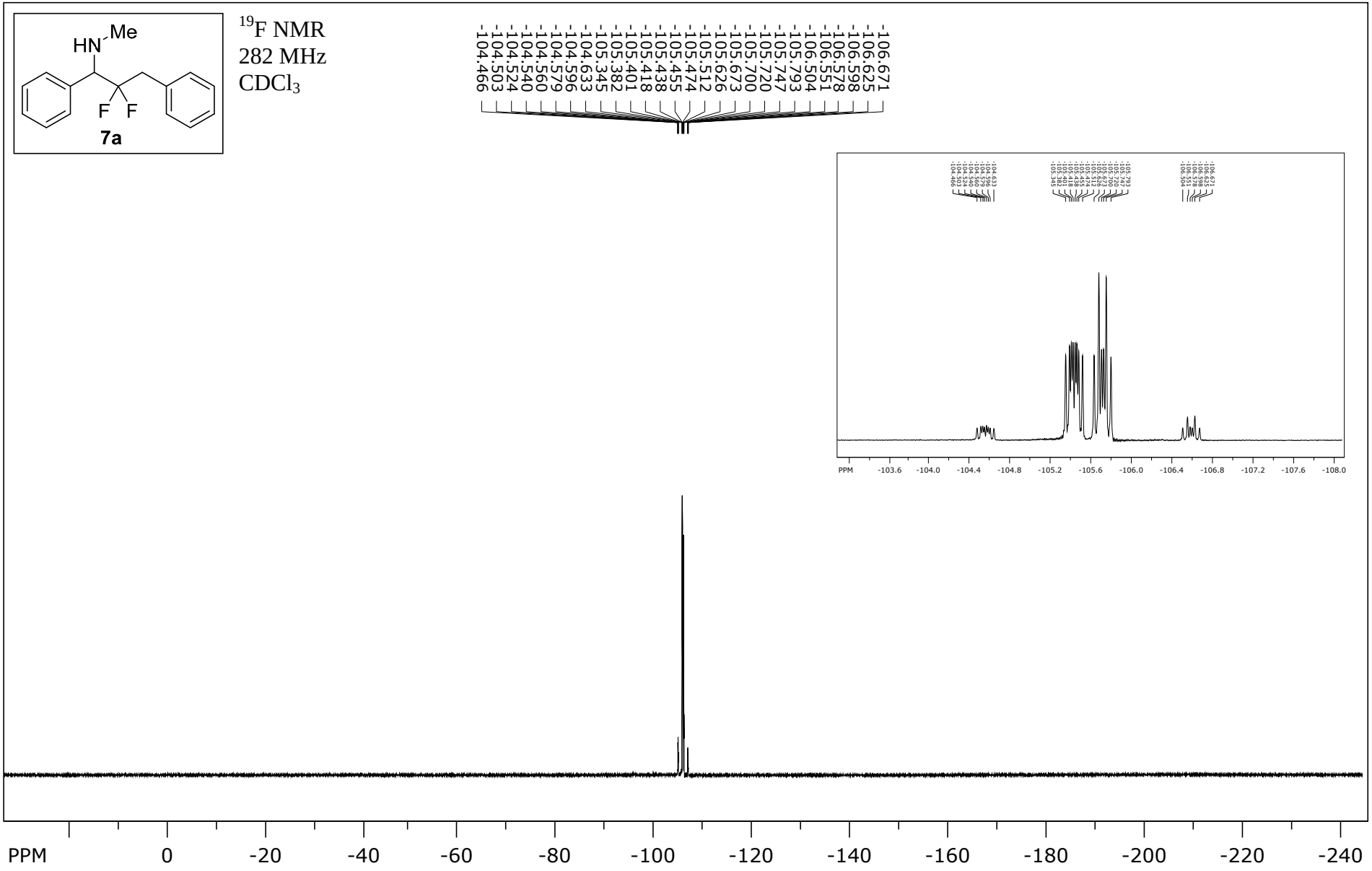
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$

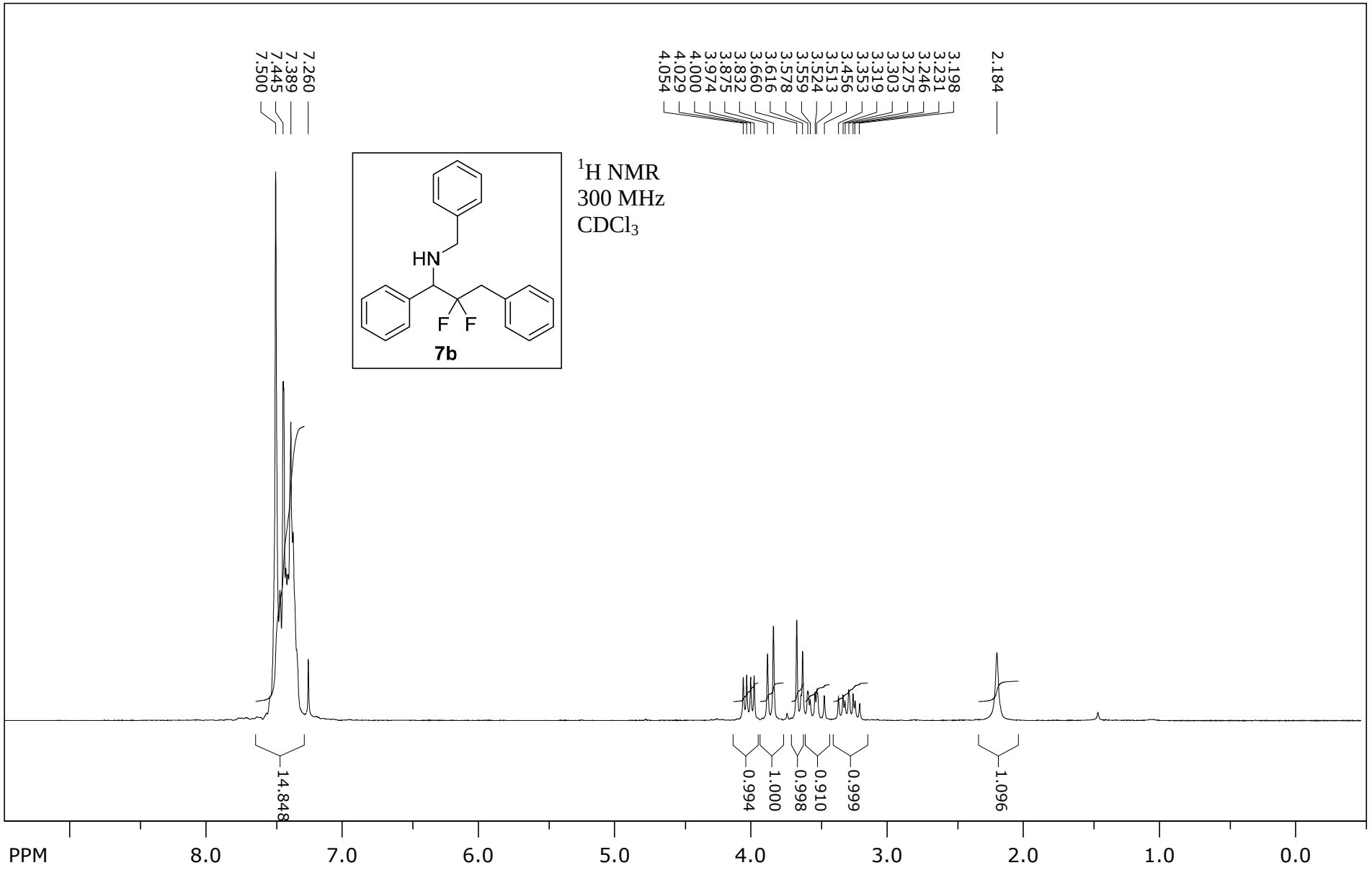

HO
N
Me
N
F
F
CF3
6h
19F NMR
282 MHz
CDCl3
-86.755
-115.819
-115.865
-115.905
-115.953
-116.761
-116.829
-116.894
-117.466
-117.546
-117.605
-118.407
-118.453
-118.495
-118.544
PPM -115.7 -115.9-116.1 -116.3 -116.5-116.7 -116.9-117.1 -117.3-117.5 -117.7-117.9 -118.1-118.3 -118.5-118.7 -118.9-119.1
3.093
2.000
PPM 0 -20 -40 -60 -80 -100 -120 -140 -160 -180 -200

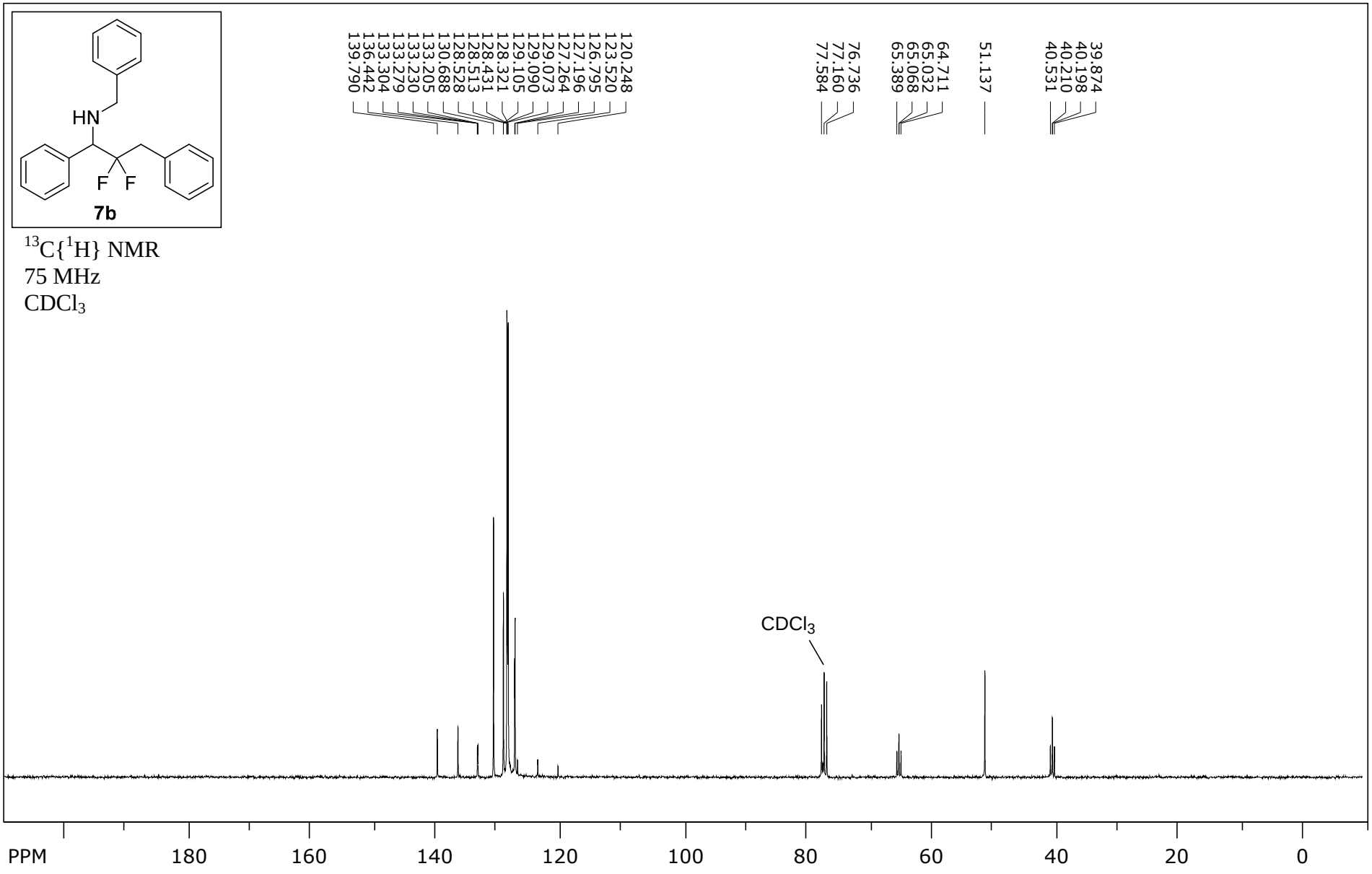

7.452
7.424
7.409
7.405
7.348
7.328
7.261
3.819
3.785
3.772
3.738
3.502
3.452
3.432
3.402
3.382
3.331
3.191
3.152
3.143
3.119
3.102
3.079
3.071
3.032
2.342
1.789
HN
Me
F F
7a
1H NMR
300 MHz
CDCl3
10.127
1.000
1.015
0.994
3.139
1.092
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

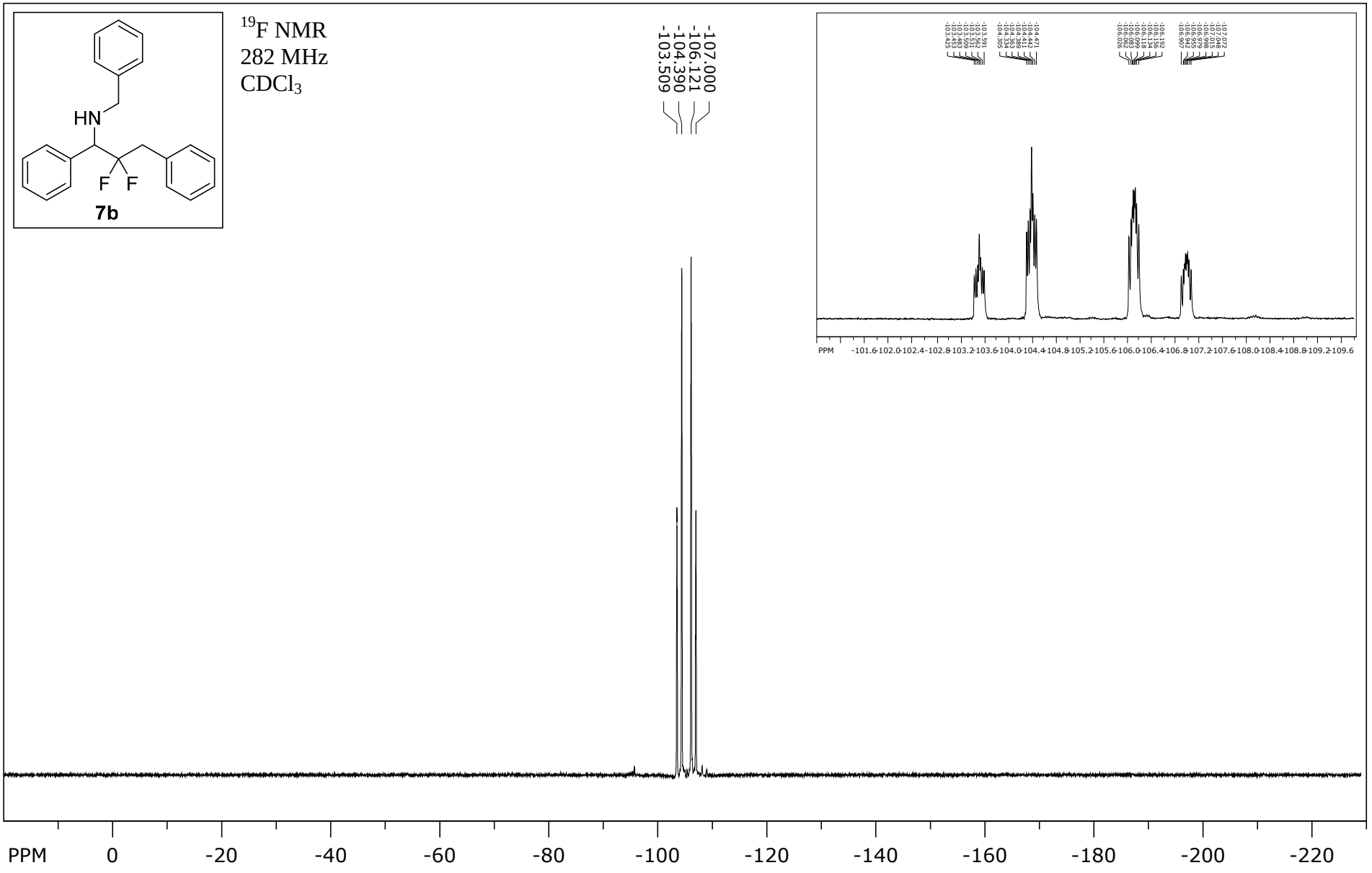


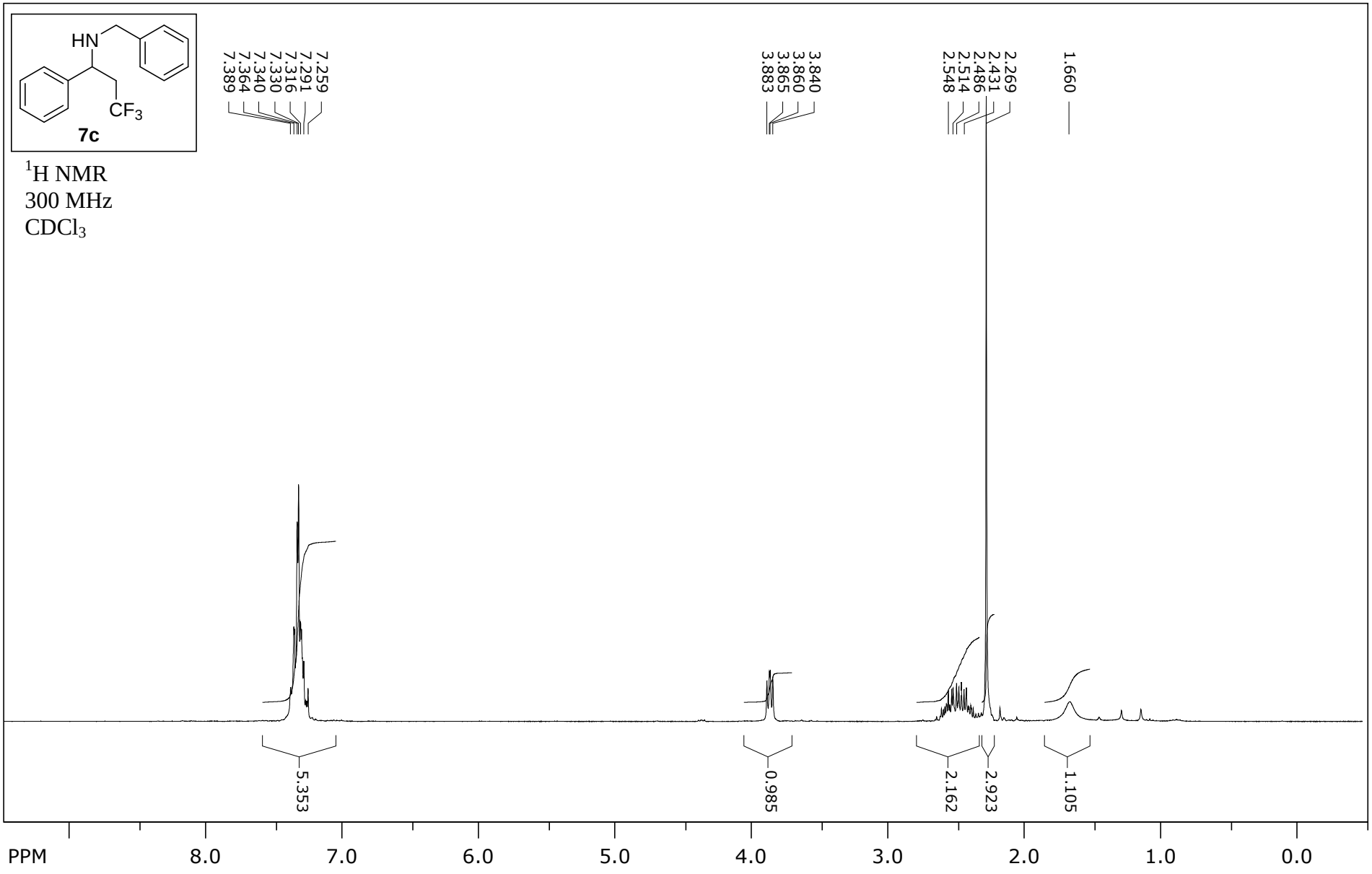
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$

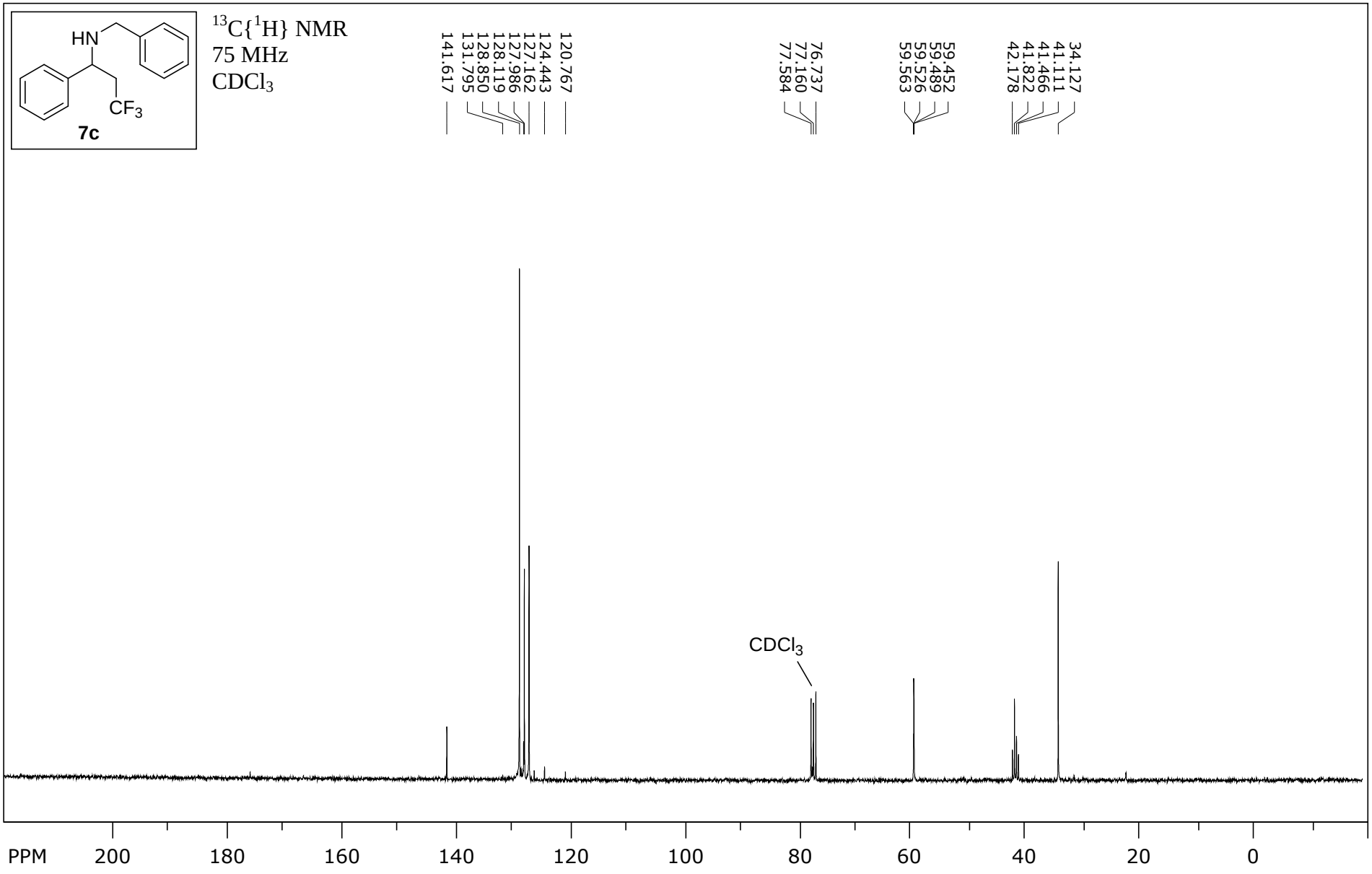

HN
Me
F F
7a
19F NMR
282 MHz
CDCl3
-104.466
-104.503
-104.524
-104.540
-104.560
-104.579
-104.596
-104.633
-105.345
-105.382
-105.401
-105.418
-105.438
-105.455
-105.474
-105.512
-105.626
-105.673
-105.700
-105.720
-105.747
-105.793
-106.504
-106.551
-106.578
-106.598
-106.625
-106.671
PPM
-103.6
-104.0
-104.4
-104.8
-105.2
-105.6
-106.0
-106.4
-106.8
-107.2
-107.6
-108.0
PPM
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
-220
-240

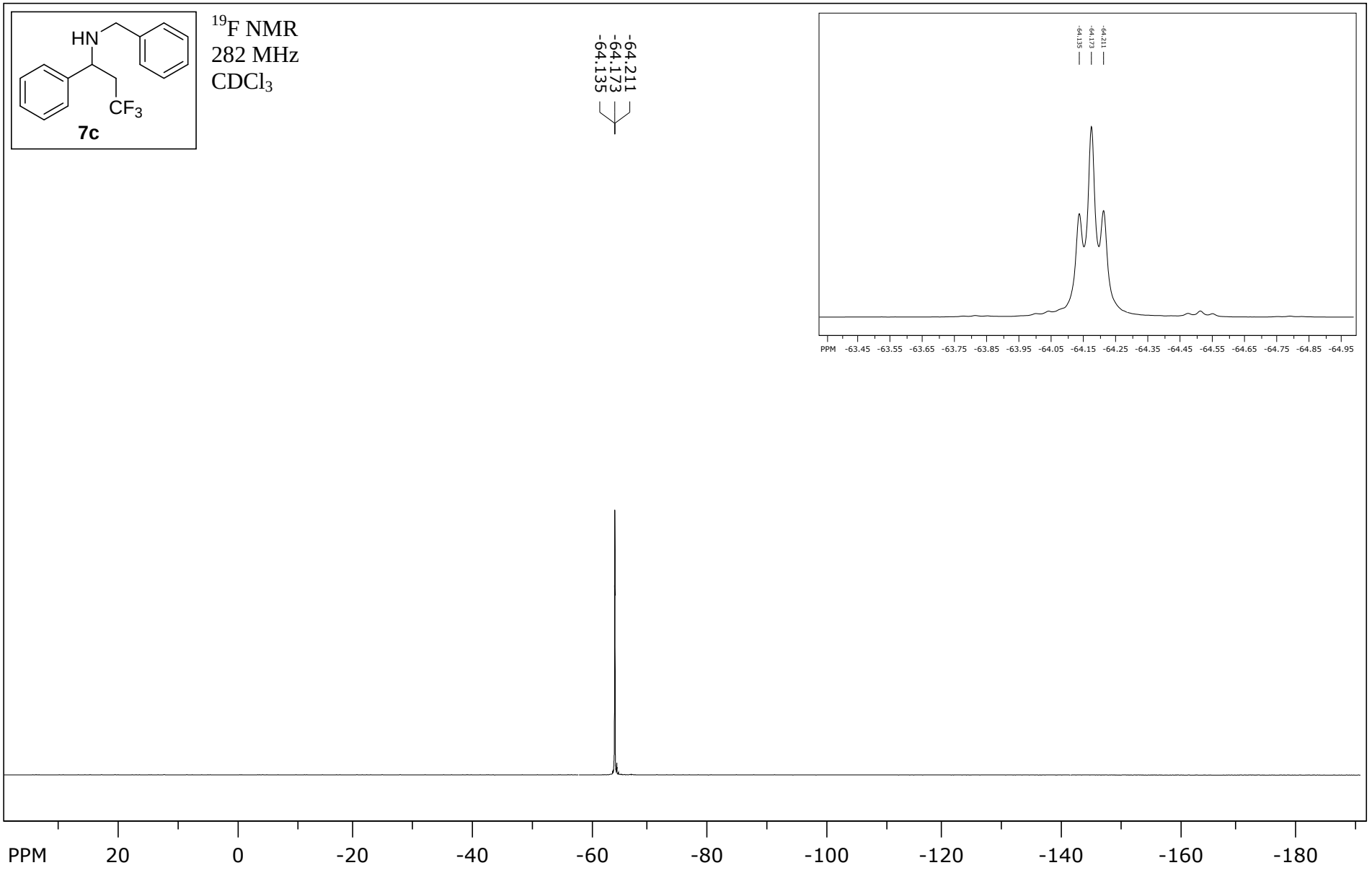

7.500
7.445
7.389
7.260
4.054
4.029
4.000
3.974
3.875
3.832
3.660
3.616
3.578
3.559
3.524
3.513
3.456
3.353
3.319
3.303
3.275
3.246
3.231
3.198
2.184
HN
F F
7b
1H NMR
300 MHz
CDCl3
14.848
0.994
1.000
0.998
0.910
0.999
1.096
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0


HN
F F
7b
139.790
136.442
133.304
133.279
133.230
133.205
130.688
128.528
128.513
128.431
128.321
129.105
129.090
129.073
127.264
127.196
126.795
123.520
120.248
77.584
77.160
76.736
65.389
65.068
65.032
64.711
51.137
40.531
40.210
40.198
39.874
$^{13}C\{^{1}H\}$ NMR
75 MHz
$CDCl_3$
$CDCl_3$
PPM
180
160
140
120
100
80
60
40
20
0


HN
F F
7b
^{19}F NMR
282 MHz
$CDCl_3$
-103.509
-104.390
-106.121
-107.000
PPM
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
-220


HN
CF3
7c
7.389
7.364
7.340
7.330
7.316
7.291
7.259
3.883
3.865
3.860
3.840
2.548
2.514
2.486
2.431
2.269
1.660
1H NMR
300 MHz
CDCl3
5.353
0.985
2.162
2.923
1.105
PPM
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0


HN
CF3
7c
13C{1H} NMR
75 MHz
CDCl3
141.617
131.795
128.850
128.119
127.986
127.162
124.443
120.767
77.584
77.160
76.737
59.563
59.526
59.489
59.452
42.178
41.822
41.466
41.111
34.127
CDCl3
PPM
200
180
160
140
120
100
80
60
40
20
0


HN
CF3
7c
19F NMR
282 MHz
CDCl3
-64.135
-64.173
-64.211
PPM -63.45 -63.55 -63.65 -63.75 -63.85 -63.95 -64.05 -64.15 -64.25 -64.35 -64.45 -64.55 -64.65 -64.75 -64.85 -64.95
PPM 20 0 -20 -40 -60 -80 -100 -120 -140 -160 -180